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CIVIL ENGINEERING, THE ARTS AND MANUFACTURES,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

EDITED

BY THOMAS P. JONES, M. D.

MEMBER OF THE AMERICAN PHILOSOPHICAL SOCIETY, OF THE ACADEMY OF NATURAL SCIENCES, PHILADELPHIA, THE AMERICAN ACADEMY OF ARTS AND SCIENCES, MASSACHUSETTS, AND CORRESPONDING MEMBER OF THE POLYTECHNIC SOCIETY OF PARIS.

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JANUARY, 1839.

Practical and Theoretical Mechanics and Chemistry.

Experiments on two varieties of Iron, manufactured at the Adirondack works, directly from the Magnetic Ore of McIntyre, Essex county, New York, by WALTER R. JOHNSON, late Professor of Mechanics and Natural Philosophy, in the Franklin Institute, Philadelphia.

The portion of the state of New York bounded eastwardly by lakes George and Champlain, northwardly by the Canada line, and northwestwardly by the river St. Lawrence, embracing the counties of Warren, Essex, Hamilton, Clinton, Franklin, and St. Lawrence, appears from various representations to be peculiarly rich in the magnetic ores of iron. We may refer in particular to Mr. Redfield's account of his exploring visits to the northern sources of the Hudson,* and to Messrs Hall and Emmons' geological reports relative to this part of the state of New York.

Mr. Hall observes that "about a mile north of the inlet of lake Sandford" (the site of the settlement at McIntyre) "in the bed and on both sides of the stream, is a bed of ore which cannot be much less than 500 feet wide, and in all probability far exceeds that breadth. This bed, with one or two minor ones on each side of the stream, has been traced for three-fourths of a mile in a northerly direction, and probably continues much farther southerly, as the great number of boulders and angular fragments of ore lying on the surface and imbedded in the soil seem to indicate. Some of these boulders of ore cannot weigh less than three tons."†

This ore, it appears, occurs in beds, and not in veins, since it lies "parallel to the direction of the mountain ranges, and when in gneiss, parallel to its apparent stratification."

Mr. Emmons, considers‡ "that the beds about McIntyre are parts of a belt of an iron formation, which extends southwestwardly through the wilder-

* American Journal of Science, vol xxxiii, p. 303, Jan. 1838.

† First Geological Report of New York, Feb. 1837, p. 131.

‡ Second Geological Report of New York, Feb., 1838, p. 223.

ness to the town of Chaumont, in St. Lawrence county; and that along the line connecting those places, many beds remain to be discovered. No *one* of these beds of iron may be equal to those of Missouri, still, *put together*, there is a much greater quantity of it, and more advantageously distributed."

The ore at McIntyre is stated to be in immediate connexion with a primitive rock, the chief ingredient of which is Labrador feldspar.

Two varieties of ore were received, accompanying the two kinds of iron, herein referred to. The first variety is of a granular but compact structure, colour of fresh fractures deep black, shining; that of weathered surfaces reddish brown, owing to the formation of a little peroxide; its specific gravity is 4.2322. The second variety has a compound structure, being in part amorphous and in part crystalline. The colour is a brownish black, except that of the crystalline portions, which is jet black. Its specific gravity it 4.6636.

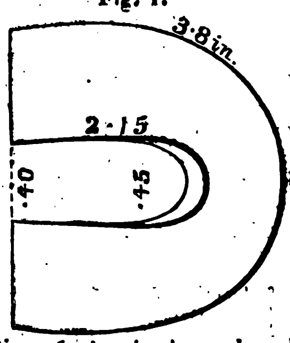
From this latter ore both specimens of the iron were produced, but their difference consisted chiefly in this, that No. 1 was wrought at a higher temperature than that applied to No. 2. The locality of these ores and the site of the Iron Works at McIntyre is about 45 miles westward from lake Champlain, between lake Sanford and lake Henderson, which are one mile apart, and according to Mr. Emmons' barometrical measurement, it is at an elevation of 1889 feet above tide water. The north branch of the Hudson in the distance of this one mile has a fall of 100 feet. The method of manufacture is by calcining the ore in kilns, breaking up and separating the purer parts by revolving magnets, reducing these to a malleable state in a forge fire, and drawing the loup out under a common tilt hammer—ready for the market. This method is likewise pursued by the Peru Iron Company at Clintonville, also at other works in Clinton county, in which about 3 or 4000 tons of malleable iron are manufactured per annum.

The appearance of the two varieties of iron when received was in some respects different. The structure of No. 1, was the more compact and fibrous; that of No. 2, more granular and crystalline, as indicated at the ends where the bar had been cut off with a cold chisel. No. 2 also exhibited two or three dark seams running along it longitudinally, and indicating less perfection in the welding, than would be desirable.

Experiments on No. 1.

To ascertain the toughness and ductility of this iron when cold, I caused the bar to be bent at a temperature of 50° at a part where the breadth was 1.295 inches, and the thickness .59 inch. This bend was made flatwise, and continued until the corresponding faces on the inside, about one inch from the middle of the inner curve, were four-tenths of an inch apart, and the widest part of the opening only .45 of an inch. The alteration in the form of the bar appeared to be limited to this portion. On measuring along the interior and exterior edges of this curve, the former was found to be 2.15, and the latter 3.8 inches, manifesting a difference in the length of the inner and outer fibres of 1.65 inches in a length of about 2¼, the original extent of the bent portion. See Fig. 1.

Fig. 1.



By this trial the whole form of the cross section of a bar is changed, and

instead of straight lines exhibits only curves.—In the present case the parallellogram Fig. 2, was converted into the form of Fig. 3, the largest curve being on the inside of the bend.

Fig. 2.

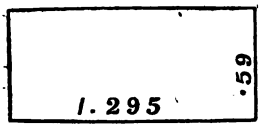
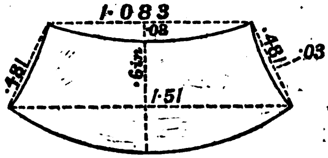


Fig. 3.



This change of figure and displacement of parts were borne without exhibiting any signs of rupture until the curvature above stated had been attained, when a few cracks began to appear, on the exterior part of the curve.

The next test to which this iron was subjected was to heat a portion of the bar to redness, quench it in cold water and then bend the same portion cold, in the manner already described. No difference of result was obtained except a greater facility in producing it. A few slight surface cracks were seen near the close of the operation.

A third trial of a similar kind on a bar annealed and cooled in dry ashes resulted like the preceding, but exhibited rather more cracks on the exterior surface of the bend than either of the foregoing.

Another trial of the toughness of this iron when cold, was made by drawing out a bar .7 of an inch wide, .18 inch thick, and 5.4 inch long, and twisting it cold in the manner of a common twisted auger, twice round in the length just specified. The edges of the spiral were now exactly 7 inches long. Hence, the elongation of the exterior fibres on the edges was $\frac{7.-5.4}{5.4} = 29.6$ per cent. It is proper to state that this experiment was made after annealing the bar, and cooling it off in dry ashes. In attempting to carry the torsion beyond this extent, the bar was twisted off at the jaws of the vice, in which the operation was performed.

Having thus proved that this iron is not under any circumstances *cold-short*, I caused the bar 1⅝ inches wide, and .6 inch thick, to be heated to a fair working red heat, and in that state bent flatwise over the corner of an anvil, and a right angle exterior and interior to be formed ¾ of an inch from the end. The exterior angle remained perfectly sound. On the interior, a thin scale only of metal appeared to be corrugated and partly detached from the rest of the mass, owing, probably, to a defect in welding—but not the least sign of a tendency to fracture was discovered. Another portion of the same bar was heated as before and 3 inches of it bent over and hammered flat upon the face of the adjacent part.

Complaints are made by workmen that much of the iron which they employ will not sustain either of the two preceding operations. They were, however, borne by the iron under trial, without evincing any weakness or undue distortion of parts. A slight splintering, similar to that just mentioned, and on the same side of the bar, was seen in the present case.

A third test of the quality of this iron, when hot, was afforded by heating about 3 inches near the end of the bars and driving a steel punch .8 of an inch in diameter, quite through it. This was done without spliting or cracking at the edges, as is too often the case in making screw nuts. Machinists are well aware of the importance of a good material for the formation of screws and nuts.

The foregoing trials having, it was conceived, fully established the freedom of this iron from the defects known either as *hot shortness* or *cold shortness*, and its softness and malleability being amply tested by the cutting and hammering incident to these experiments, the next step was to determine the absolute force of cohesion, together with the extensibility, when subjected to longitudinal strain, and the interior structure of the metal under various circumstances, including that of welding in the ordinary way.

For this purpose five bars were drawn out and prepared from the specimens already described, numbered I, II, III, IV, and IX, each about 9 or 10 inches long, 1 inch wide and .2 inch thick.

No. I. after being reduced to a nearly uniform size throughout its length, was annealed at a red heat and allowed to cool slowly in the air.

No. II. was *hammer hardened*, or beaten with moderate force, throughout its length until it had been for several minutes black, the hammer being occasionally moistened during the process.

No. III. was forged out and hammered till it was only visibly red in daylight, being left at about the temperature at which workmen cease their operations on many of the articles which they produce.

No. IV. after being brought to a uniform size, was upset for about 3 inches, in the middle, and was then annealed and cooled slowly.

No. IX. was drawn out, cut in two in the middle, and welded together. This sample was only 6½ inches long.

All these bars were then carefully gauged, both in breadth and thickness, at every inch of their lengths, before commencing the trials of tenacity. The machine employed in testing them was the same which had been used in experiments made at the request of the Treasury Department, on the strength of materials for steam boilers, for a description of which the reader may be referred to the report on that subject.* The following table will be understood without any other remark than that the breaking weights in the 5th column, are corrected for friction of the machine. The specific gravities of several of the fragments of each bar after it had been broken up, are given under the head of observations, and may serve as well to illustrate the general character of the iron in this respect, as to indicate the effect of the several methods of preparation on the density of iron.

The following experiments confirm the evidence already adduced of the great toughness and ductility of this variety of iron. Besides the facts mentioned under the head of *observations* in the 7th column we may add that after the first fracture on each bar, a measurement was taken between two of the inch marks still remaining on one of its parts and the following results obtained, viz:

No. I.	In an original length of		6 in.,	had been elongated		.87 in.	=14.5	pr. ct.
II.	"	"	4 "	"	"	.2 "	= 5	"
III.	"	"	5 "	"	"	.6 "	=12	"
IV.	"	"	4 "	"	"	.2 "	= 5	"

* See also Journal of the Franklin Institute, vol. xix, p 84.

TABLE I.

Experiments on the tenacity of iron in specimen No. 1.

No. of the bar.	State of the Bar.	No. of the experiment	Area of section before trial in sq. inches.	Breaking weight in lbs., avoirdupois.	Strength in pounds per sq. inch.	Observations.
I.	Completely annealed.	1	.1890	10.175	53.820	Length before trial, 10 inches, after, 13.5—total elongation 35 pr. ct. Sp. Gr. after trial 7.685, 7.676, 7.668. Mean = 7.676. After the 4th fracture the area of section was .1064 in. instead of .1986 as at first, diminution 46 pr. ct. Mean strength of this bar 53.311. Greatest difference 1706 lbs = 3.2 pr. ct. of the mean.
		2	.1929	10.288	53.336	
		3	.1954	10.345.5	52.945	
		4	.1986	10.374	52.235	
		5	.2036	10.972.5	53.941	
		6	.2057	11.029.5	53.614	
II.	Hammer hardened.	1	.1980	12.967.5	65,492	Length before trial 9⅛ in., after, 11 in.—total elongation 20.5 pr. ct. Sp. Gr, after trial, 7.769, 7.756, 7.779, mean = 7.768. Mean strength 65.713.—Greatest difference 2348 lbs = 3.5 pr. ct. of the mean.
		2	.2019	13.053	64.650	
		3	.2000	13.399.75	66.998	
III.	Hammered till nearly black.	1	.1983	11.970	60.363	Length before trial 9.5 in., after 12¼—total elongation 28.94 pr. ct. Sp. Gr. 7.760, 7.778, 7.662, mean = 7.750. After the 2d fracture the area of section at the point of fracture was .1176—diminution 45.2 pr. ct. Mean strength 58.912.—Greatest difference 2.444 lbs = 4.15 pr. ct. of the mean.
		2	.2151	12.454.5	57.919	
		3	.2163	12.768	59.029	
		4	.2213	12.910.5	58.339	
IV.	Upset in the centre and annealed.	1	.2086	13.110	62.847	Length before trial 9, after 11.2—total elongation 24.46 pr. ct. of original length, Sp. Gr. after trial 7.813, 7.731, 7.754, 7.634, mean = 7.733. Mean strength 63.142.—Greatest difference 7.128 lbs. = 11.2 pr. ct. of the mean. The last two results belong to the upset portion of the bar. The thickest part of the upsetting remained, however, unbroken.
		2	.2233	13.623	61.007	
		3	.2316	13.737	59.313	
		4	.2282	15.162	66.441	
		5	.2354	15.561	66.104	
IX.	Welded together near the middle—hammered till nearly black.	1	.1845	10.773	5839 5	Broke outside of welding. The strength is about the same as in No. III.

To compare this iron with others, it is proper to assume bar No. III as the standard, that having been hammered till of a dull red heat. The report already cited furnishes us with abundant data derived from experiments, made with the same machine, on other kinds of bar iron, in a similar state. Thus we have—

				Strength in lbs. pr. sq. inch.
Iron from	Salisbury, Conn., by a mean of	40	trials,	58.009
"	Sweden, "	4	"	58.184
"	Centre Co., Pa., "	15	"	58.400
"	Lancaster Co., Pa., "	2	"	58·661
"	McIntyre, Essex Co., N. Y. (as above)	4	"	58.912
"	England, cable bolt (E. V.)	5	"	59.105
"	Russia,	5	"	76.069

Hence it appears that the last only is essentially superior to the iron of McIntyre. These are among the best varieties of bar iron in point of tenacity. The second class will be mentioned below.

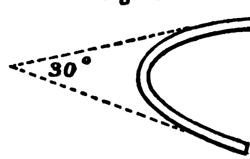
The fracture of No. I is of a light iron grey colour, silky lustre, and generally displays a compact structure. It is worthy of remark that most of the fractures took place in directions oblique to the line of tension and making with it, either in the breadth or thickness, one or more angles of about 60 degrees each.

The fibrous structure of the metal was very marked in cutting with the cold chisel and was further developed by acids on a part of No. III, on the surface of which delicate lines were shown traversing a distance of several inches. The specific gravity in the annealed state was, it appears, increased 1.2 per cent by hammer hardening.

Experiments on No. 2.

This was a bar one inch square and about two feet long. It was first bent *cold*, till incipient fracture appeared on the outer edges of the curve, which took place when the two limbs had approached so as to make an angle of 30° with each other. Fig. 4.

Fig. 4.



The exterior fibres in the part to which the change of form had been confined were then found to have a length of 7.43 inches, while those on the inside had but 4.8 inches. The difference 2.63 is to be attributed to the combined influence of compression and elongation of the interior and exterior fibres respectively, and by measuring and marking bars before and after bending them, may, under certain restrictions, be employed as a means of determining the positions of neutral axes. Changes analogous to those already observed in the form of the cross section were also remarked in the present instance.

The next trial was by turning a right angle, when hot, on a short portion of the bar and subsequently folding another part over flat upon one of its faces. All the phenomena of developing curves out of the square cross section were beautifully illustrated, and the soundness of the iron, when thus tested at a red heat, incontestably proved. A short portion of this inch square bar was heated to a fair working temperature and perforated with a punch $\frac{5}{8}$ of an inch in diameter. No signs of cracking were observed.

Four bars were prepared in all respects similar to the first four taken from specimen No. 1, and respectively treated in the same way preparatory to a trial of their tenacity. The bar marked,

V. Was completely *annealed*.
VI. " *hammer hardened*.
VII. " *hammered to a dull red heat*.
VIII. " *upset in the middle and annealed*.

As the upsetting of No. VIII had increased the thickness of that part to

which the operation was confined, care was taken to reduce by filing the cross section in the middle of the upset portion to less than that of the rest of the bar, in order to insure a fracture in metal, actually in that state. The trials on No. IV had led to the supposition of an increase of strength by the process of *upsetting*, contrary to an opinion entertained by some practical men. Experiment No 2, in the following table, on bar No. VIII, in which the fracture took place at the filed section, gives not only the highest result on that bar, but also higher than any other obtained from this variety of iron except those derived from the hammer hardened bar No. VI, and consequently confirms our previous deductions.

TABLE II.

Experiments on the tenacity of Iron in specimen No. 2.

No. of the bar.	State of the Bar.	No. of the experiment	Area of section before trial in sq. inches.	Breaking weight in lbs., avoirdupois.	Strength in pounds per sq. inch.	Observations.
V.	Completely annealed.	1	.2097	9.946.5	47.425	Length before trial $10\frac{1}{4}$ in., after trial 14.2—total elongation 30.5 pr. ct. Sp. Gr. after trial 7.680, 7.440, 7.670, mean = 7.596. Mean strength 47.328.—Greatest difference 1080 lbs. = 2.3 pr. ct. of the mean.
		2	.2121	10.146	47.836	
		3	.2131	10.146	47.836	
		4	.2132	9.975	46.785	
		5	.2237	10.459.5	46.756	
VI.	Hammer hardened.	1	.2295	12.169.5	53.026	Length before trial 10 in., after trial 12 in.—total elongation 20 pr. ct. Sp. Gr. after trial 7.608, 7.700, 7.718, mean = 7.675. Mean strength 55.657.—Greatest difference 4.569 lbs. = 8,2 pr. ct. of the mean.
		2	.2226	12.283.5	55.182	
		3	.2202	12.682.5	57.595	
		4	.2302	13.081.5	56.826	
VII.	Hammered to a dull red heat.	1	.2195	10.659	48.560	Length before trial 10 in., after trial 12.6—total elongation 26 pr. ct. Sp. Gr. after trial 7.654, 7 709, 7.712, mean = 7.602. Mean strength 49.215.—Greatest difference 2433 lbs. = 4.9 pr. ct. of the mean.
		2	.2233	10.687.5	47.861	
		3	.2154	10.801.5	50.146	
		4	.2159	10.858.5	50.294	
VIII.	Upset in the centre and annealed.	1	.2318	10.972.5	47.336	Length before trial $9\frac{1}{4}$ in., after trial 12.3—total elongation 32.9 pr. ct. Sp. Gr. 7.800, 7.827, 7.592, mean = 7.739. Mean strength 49.311.—Greatest difference 4140 lbs. = 8.4 pr. ct. of the mean. The experiments 1 and 5 on parts not upset conform very nearly to the mean of the annealed Bar No. V.
		2	.2242	11.542.5	51.484	
		3	.2317	11.913	51.415	
		4	.2430	11.941.5	49.141	
		5	.2513	11.856	47.178	

The elongations observed after the first fracture on each bar were as follows:

No. V.	In an original length of 6 in.	had been elongated	.9 in.	=	15 pr. ct.
VI.	" " 5 "	" "	.3 "	=	6 "
VII.	" " 5 "	" "	.85 "	=	17 "
VIII.	" " 5 "	" "	.55 "	=	11. "

This variety of iron is thus seen to exhibit an extensibility by this mode of trial, rather less than that of No. 1,—the mean here being for the four bars 12¼ per cent, and for the four bars from No. 1, 13$\frac{6}{10}$ per cent. But on comparing the total elongations of all the bars after fracture we find

From specimen No. 1.	No. I. gave 35. pr. ct.		mean 27.2.
	II. " 20.5 "		
	III. " 28.9 "		
	IV. " 24.4 "		
From specimen No. 2.	No. V. gave 38.5 pr. ct.		mean 29.3.
	VI. " 20. "		
	VII. " 26. "		
	VIII. " 32.9 "		

From these two comparisons we may infer that there is but little difference between the two kinds of iron in regard to extensibility. From both modes of comparison, however, we are led to notice the remarkable difference between the annealed and hammer-hardened bars. By observing elongations after the first trial, we have 14.5: 5, and 15: 6, for the rates in the two kinds of iron; and by taking the total elongations, we have 35: 20.5, and 38.5: 20 for the relations. This is in accordance with what had been observed while making experiments on the strength of materials for steam boilers.

The difference in specific gravity between the annealed and hammer hardened bars from specimen No. 2, is 1.01 per cent. The iron now under consideration may be compared, in point of tenacity, with American bar iron of the second class only.

Thus from the Report before cited, we find that

				lbs. pr. sq. in.
Bar iron from Missouri	by 22	experiments, bore		47.420
" McIntyre,	" 4	"	on bar No. VIII (as above)	49.215
" Tennessee,	" 21	"		52.909
" Baltimore,	" 13	"		55.213

Assuming the strength of specimen No. 1, in each state in which it was tried as the standard, we find the following results of a comparison between the two kinds of metal above examined, viz:

Nos. I. & V. give $\frac{53.311 - 47.328}{53.311}$ = 11 pr. ct. inferiority in No. 2, when annealed.

II. & VI. give $\frac{65.713 - 55.657}{65.713}$ = 15.3 pr. ct. inferiority in No. 2, hammer hardened.

III. & VII. give $\frac{58.912 - 49.215}{58.912}$ = 16.4 pr. ct. inferiority in No. 2, hammered to dull red.

IV. & VIII. give $\frac{63.142 - 49.311}{63.142}$ = 21.9 pr. ct. inferiority in No. 2, upset and annealed.

The mean difference is 16.15 pr. ct. in favour of No. 1, or about one sixth of its total tenacity.

The fracture of No. 2, presents less of the clear fibrous texture, silky lustre, and uniform compactness, than ought to characterize an iron of the first quality.

A few general remarks seem worthy of attention in connexion with the subject of tenacity as presented by these experiments. The first is, that in the annealed state, different kinds of iron more nearly resemble each other in respect to strength, than in any other condition. This is verified by the last comparison in which the difference between the two kinds when annealed is seen to be only 11 per cent, while in the other three conditions, it varies from 15.3 to 21.9 per cent.

The *second* remark is, that in the *annealed* state, the same bar has greater uniformity within itself than in any other case. This is proved by comparing the *greatest differences*, as stated in tables I and II, in the column of *observations*.

The two *annealed* bars are there seen to give for these differences between their highest and lowest, results 3.2 and 2.3 pr. ct., mean = 2.75

The two *hammer hardened* bars	gave 3.5	" 8.2	" "	= 5.85
" *hammered to dull red heat,*	" 4.15	" 4.9	" "	= 4.425
" *upset and annealed,*	" 11.2	" 8.4	" "	= 9.8

The experiments on the annealed bars were, in both cases, at least as numerous as those on the *same kind of iron* in any other state, and hence, other things being equal, ought to have presented at least equal discrepancies; while in fact these are scarcely more then one half as great as the *least* of the others, and are less than one third as great in *either instance*, as those found in the *upset and annealed* bars.

The *third* observation I would make is, that in upsetting part of a bar and subsequently annealing the whole of it, the differences between different kinds of iron, and between the several parts of the same bar, are both at a maximum. The two varieties of iron gave a difference of nearly 22 per cent. from each other, and their mean diversity for the same bar is 9.8 per cent. of its mean strength. This may satisfactorily be explained only on the supposition that upsetting iron *increases* its direct cohesion, since we know that annealing *diminishes* it, while the structure is thereby rendered more uniform.

Our next remark is that between the *ordinary* and the *hammer hardened* state of No. 1, there is a difference in tenacity of 11.7 per cent. of the strength in the former condition; and that for No. 2, this difference amounts to 13 per cent. The English cable bolt iron above mentioned, manifested a difference of 20 per cent. under similar diversity of treatment. The difference between the tenacity of No 1 when annealed, and that when hammer hardened is 23.3 per cent. of the strength when annealed; and for No. 2 this difference is 17.6 per cent. Now as we have already proved that *hammer hardening* diminishes the extensibility of a bar, it must follow that *stiffness as well as strength is essentially augmented by this treatment.*

It may be further remarked that by 13 trials the stronger variety of McIntyre iron had a specific gravity of 7.728, and by 12 trials that of the weaker kind was found to be 7.676, the difference .052 being = .6 of one per cent, and that the mean specific gravity of other kinds of bar iron formerly tried was found by 17 trials to be 7.725. The Russian iron above mentioned had by the mean of 10 trials on separate portions of the same bar a specific gravity of 7.801, the highest being 78.702 and the lowest 77.586. These facts, in connexion with the increase both of strength and specific gravity by hammer hardening appear to favour, though perhaps they do not establish,

the supposition that *whether from chemical constitution or from mechanical treatment, a deficiency in specific gravity is an indication of inferiority* in the strength of iron. I am aware of some apparent exceptions to this rule.

In conclusion it may be observed that the great amount of much worse iron which finds its way into the American market, will render even the McIntyre iron No. 2, an object worthy the attention of the consumers of this article. But as a large and an increasing demand for good iron prevails in the United States, in proportion to the increase of finished and accurate machinery requiring superior materials as well as workmanship, there can be no doubt that any quantity which could probably be produced, if possessing the properties of No. 1, would command a ready market and the best of prices.

Civil Engineering.

Some remarks on the Internal Improvement System of the South, by John C. Trautwine, Engineer in Chief of the Hiwassee R. R.

WITH A MAP.

For some time after the introduction of rail-roads into our Union, their construction was confined almost exclusively to the northern states. To Pennsylvania is due the credit of having been foremost in the cause of state rail-roads, as she had before been in that of state canals. She has, through either her Legislature, or chartered companies, expended the heavy sum of thirty millions of dollars, in works more or less intimately connected with internal improvements. Large expenditures had also been made in Maryland, Delaware, New Jersey, New York, the New England states, and Virginia, for a considerable time before the importance of the internal improvement system appeared to manifest itself to the more southern portion of the Union; and with, I believe, the single exception of the South Carolina rail-road in 1830, but little or nothing of importance had been done to further its advancement, until within the last 3 or 4 years.

The river Ohio (see accompanying map) in connexion with the improvements of New York and Pennsylvania, has hitherto been the great thoroughfare along which merchants of the west and interior have sought the markets of New York, Philadelphia, Baltimore, and other northern Atlantic cities; and along which they have in return transported to their several states, the goods purchased in those cities. South of the Ohio, they have never had offered inducements to visit the southern ports. Five or six hundred miles of miserable roads, nearly impassible in winter, have effectually shut out all intercourse between the merchants of the west and the Atlantic seaports of the south. The only rival of the northern cities in the trade of the north western states, and of the interior, has been New Orleans; to which an easy access is had down the Mississippi river. But even there the trade has been confined principally to groceries, of which the sugar and molasses manufactured near New Orleans, constitute the principal items. As respects merchandise, the sales there are principally made to retailers, living along the banks of the river, who send down produce to New Orleans, and receive return loads of groceries and merchandise in exchange. The *wholesale* merchants even along the Mississippi river, and of the states of Mississippi, Alabama, Georgia and Tennessee, as well as those of the north western states, make their purchases in the northern cities; which in the sale of all articles of European manufacture, enjoy almost an exclusive monopoly.

This is owing in a great measure to the superiority of the navigation between them and Europe, over that between New Orleans and Europe. Not only is the voyage to New Orleans the longer by more than 1000 miles, but it is rendered comparatively dangerous by the intricate passages, and obstructed navigation of the Bahama banks and capes of Florida.*

This objection, however, does not apply to the cities of the southern Atlantic sea board. The navigation from Europe to Charleston and Savannah, is at least as good, if not better, than that to the northern cities. Moreover the south would have a very important advantage over the north, in the mildness of her climate, which would allow merchants to transport their goods at all seasons, without fear of obstruction from ice. Serious delays occur annually in the northern canals, from this cause. Let the south then open for the merchants of the west and interior, as good avenues to her seaports, as the cities of the north have done to theirs, and the monopoly of the latter must at once cease, and the south become a heavy importer. This she has finally resolved to do.

Within the last few years, the confidence which had been awakened in the south, by the increasing number of our northern projects, gradually became stronger; and as the success of these projects by degrees revealed itself in the realization of handsome profits, finally was confirmed. Thus experimentally convinced of the immense benefits resulting to the Atlantic cities of the north, from their numerous channels of intercourse with the west, she determined that she also would enjoy them.

This determination was promptly followed up by suggestions for various lines of rail-road, stretching from the principal Atlantic cities of the south, to the interior of our Union; where their upper extremities are to be united to the lower termini of other lines, now being constructed in the north western states of Indiana, Illinois, and Ohio, by which they will be extended even to the great lakes.

Through these connected lines of rail-roads, the merchants of the west will have as easy access to the seaports of the south, as to those of the north. The former will thus be enabled to effect an extensive importing system, and the heavy trade now monopolized by the north, will be distributed more equally along our entire sea board.

A strong impulse has been given to the southern improvements by the lively interest taken in many of them, by the several states through which they pass; the consequence of which judicious policy is, that almost every individual state south of the Potomac and west of Pennsylvania, is at this moment engaged in forming its respective link in the grandest chain of internal improvements ever suggested; and one which will in less than six years from this time, effect an almost magical change in the commercial relations of the various sections of our country.

Fortunately for the south, she has conducted her operations thus far, with a spirit of unity and concert, much more marked than that which characterised the northern projects. Her several districts, sensible that the prosperity of each depended on its means of ready intercourse with all the others, are

* Might not this difficulty be remedied in some measure, by the construction of a ship canal across the Isthmus of east Florida? Its length would probably not exceed 80 miles, and the country is very favourable for its construction. That common objection to canals, viz. their liability to obstruction by ice, would not apply here, owing to the mildness of the climate; the voyage would be greatly shortened and the most difficult and dangerous portion of it entirely avoided. This is one of the few instances in which we consider a canal *infinitely* preferable to a rail-road. WRITER.

constructing their respective lines with a view not only to the effecting of *local* considerations, but to the accomplishment of a magnificent project of *National* importance.

The most striking feature in the commercial aspect of the south, is her *Cotton growing.* The cotton country includes South Carolina, Georgia, Alabama, Mississippi, middle and west Tennessee, and large tracts west of the Mississippi river. The great demand for this article over the whole globe, renders its cultivation far more profitable to the southern landholders, than that of the common agricultural products would be. Consequently the cotton country is devoted almost exclusively to its culture; a small proportion of rice constituting nearly the only exception. The cotton is pressed and put into bales at the place where it is grown; and thence sent by land to the nearest navigable stream, down which it is transported, principally in steam boats, to the various southern ports.

The business of most of the flourishing towns of the south, depends very essentially upon the receiving and exporting of cotton; all other things remaining as at present, many of them would probably cease to exist, with the demand for that article.

It follows from this general neglect of the farming interest, that the southern population must depend upon other sections for supplying them with provisions. These they receive from the interior and north western states; but especially from Kentucky and east Tennessee, both of which districts, in point not only of agricultural, but of mineral and manufacturing resources and facilities, are excelled by no other portions of the Union.

From them, immense droves of live stock, and heavy amounts of provisions are annually sent to the cotton country, where the great distance and the wretched condition of the roads cause them to sell very high. On this account provisions command greater prices in the southern sea ports than in any other part of the United States; and as the badness of the roads and the great length of hauling necessary, will not admit of an exchange for merchandise, the sales are almost always for *cash;* of which large sums are thus annually transferred from the south to the interior and north western states. When the southern rail-roads shall be completed, this draining of cash from the cotton country, will in a great measure be counteracted by the sales of merchandize to the western merchants.

As before remarked, the universal demand for the staple product of the south, enables the southern seaports to do an immense *exporting* business. The raw cotton is from them shipped principally to Liverpool; and in England, that great manufacturing district for the whole globe, it is made up into goods, and in that state sent to every quarter of the earth.

A great quantity returns to this country; but not as one might at first suppose, to the *southern* sea ports, from which the raw material was exported; it returns to the sea ports of the *north;* because there the merchants of our immense interior congregate to make their purchases; and thus ensure a constant market.

But *why*, it will be asked, do the merchants of the interior prefer the sea ports of the north, to those of the south? The answer is simply this, *because the roads are better.* The cities of the north have by a judicious system of internal improvements, opened for the western merchant, easy routes to reach their markets; and safe and speedy ones for carrying his purchases home. While Baltimore, Philadelphia, and New York have been contending with each other, for the supremacy, by each trying to excel the other in her channels of intercourse with the west, the south has stood idly by

and done nothing. She has been content to permit not only the merchants of the interior, but even *her own, those residing in her own sea ports,* to purchase their goods in the northern cities.

She forgot that the opening of every fresh avenue to the *north,* was the obstructing of one *to her;* and heartily joined in congratulations at the increasing prosperity of her sister, unmindful that it was secured at her own expense. "Better late than never," is a good old saying; and upon its inculcations has the south at last begun to act. She has commenced, and is now energetically pushing forward, a system of rail-road improvements, which will soon present to the merchant of the interior, inducements to visit her sea ports, as well as those of the north; and by purchasing his goods there, enable her to open a direct *importing,* as well as *exporting* trade, with the other continent.

But even with the manifold benefits which must result to Charleston and Savannah, from the completion of their rail-roads to the interior, we can not, with many of our southern friends, look for those cities ever to attain the size and commercial importance of New York or Philadelphia. From the very nature of the staple (cotton), which requires comparatively few landholders, it appears to us impossible that the population of the south can ever become so dense as that of the north; and the magnitude of a market, must depend upon the number of purchasers. A large cotton grower can easily cultivate 1500 acres; while our wealthy northern farmers, rarely hold more than 500; and perhaps the majority do not exceed 250. Besides this, the inexhaustible mineral resources, the manufacturing and agricultural advantages, the more equal distribution of wealth, and I may add, the more stirring and industrious business habits incident upon the colder climate of the north, all combine to render her cities more affluent than those of the south.

Still shall the south have attained that great desideratum, a termination of her mercantile dependence on the north. Her rail-roads will enable the merchant of the interior to purchase his goods alike in New York, Philadelphia, Charleston or Savannah, as either may, from fluctuating causes, offer the best market. Instead of the heavy cash purchases of stock and provisions now necessary, an exchange of these articles for merchandise will be effected, and Savannah and Charleston will in a few years have attained an importance, with which their present condition will admit of no comparison.

But shall we permit the foreboding politician to predict from this termination of commercial dependence, a cessation of national dependence, of national feeling? Far from it. Community of intercourse will annihilate our local prejudices, will bury in oblivion the differences of by-gone times, and draw the bonds of union more close than ever.

We will now pass on to the consideration of the several lines of rail-road by which the south hopes to accomplish the grand object in which she has embarked.

A reference to the map will show that Illinois, Indiana, and Ohio are constructing several rail-roads from their respective interiors, to the Ohio river; it will show, moreover, that they are constructing some of them in such directions, that, by uniting, they will form *a continuous and very direct line of rail-road from the "Far West," passing through Cincinnati to the* Northern Sea Ports;—*and thirdly, it will show that from Cincinnati to Philadelphia by this line of rail-road, is a shorter distance than from*

Cincinnati to Charleston, by way of the Charleston and Cincinnati rail-road.

We wish these facts to be distinctly borne in mind by the reader, as we shall soon have occasion to bring them forward in support of some opinions of ours, which are opposed to those of many persons in the south, and therefore require strong arguments to sustain them.

First in importance, magnitude, and splendour of conception, of the several projects for benefiting the south by the effecting of an importing system, is the great Charleston and Cincinnati rail-road. Commencing (see map) at Charleston, this road occupies the line of the old South Carolina rail-road, as far as Branchville, 62 miles, thence it continues to Columbia, a further distance of 66 miles; thence to the North Carolina line, by a route not yet finally determined on, about 150 miles more; thence to Ashville, N. C., 41 miles; thence to the Warm Springs, 36 miles; thence along the valley of the French Broad River to Knoxville, 100 miles; (or 455 miles from Charleston to Knoxville); from Knoxville it passes on through Lexington to Cincinnati by a route not yet finally adopted, about 265 miles; in all about 720 miles.

The company for constructing this road, is chartered by the four states through which it passes; viz. South and North Carolina, Tennessee, and Kentucky. Three of them, viz. North and South Carolina and Tennessee, have also granted banking privileges; Kentucky has not yet, but probably will do so this winter. South Carolina and Tennessee have also rendered pecuniary assistance to the road; North Carolina and Kentucky have not.

Independently of the tendency of this project, considered merely as a *rail-road*, great and beneficial results are to be hoped for, from its *banking powers*. The late derangement of the money market, has plainly pointed out the necessity for a circulating medium, based on other than restricted local credit; and such a medium the Charleston and Cincinnati Company will certainly effect, *in case the rail-road be completed.*

But if this be not done, we cannot see how the interest of the states through which it is to pass, can be enlisted in its cause; the circumstance alone of its *being chartered* by four states, cannot, it appears to us, prevent it from dwindling down into a mere South Carolina bank, with an influence and credit far less extensive than those of the present United States Bank, of Pennsylvania. To prevent this it will be necessary for Tennessee and Kentucky to lend themselves freely to the work. What has already been done is too trifling, in comparison with the magnitude of the project, to deserve a moment's consideration; it is for all practical purposes only *nominal.* We hope soon to see those two states awakened to a due appreciation of the utility of the undertaking, and embark largely in it.

It will be seen on the map, that *from the city of Knoxville in Tennessee, there are laid down* TWO *continuous lines of rail-road to Charleston, S. C.*, one of these may be called the *northern* or *upper route*, and the other the *southern* or *lower route.* The upper one is that selected by the Charleston and Cincinnati Rail-road and Banking Company; its length (as just now shown) from Knoxville to Charleston is 455 miles. The lower route consists of a chain of several distinct rail-roads, commencing with the *Hiwassee Rail-road*, 98½ miles in length, which extends from Knoxville to the dividing line of Tennessee and Georgia; where it unites with the *Western and Atlantic Rail-road*, which continues 118 miles, to near Decatur in Georgia; thence the line runs to near Crawfordville 58 miles; thence by the Georgia Rail-road to Augusta, 65 miles, thence by way of the South Carolina Rail-road

to Charleston, 136 miles, in all 475½ miles. From Crawfordville to Charleston 201 miles is already completed and in full operation; and between Crawfordville and Knoxville the line is now being graded with great energy. These two lines (the upper and lower) differ very materially in their characters, the upper route being the shorter by 20½ miles; but the lower possessing so great a superiority in point of levels and curves, as will, by admitting of greater speed, enable the trip to be made on it in less time than it can on the upper route.

The lower route affords the entirely unprecedented fact of a continuous chain of rail-road, nearly 500 miles in length, carried principally through a mountainous country, yet nowhere presenting a grade exceeding 36 feet to a mile; and at the same time unincumbered by tunnels or inclined planes.* Its shortest radius of curvature is 1000 feet; and even *it*, if we mistake not, occurs only on the Western and Atlantic Rail-road; on the Hiwassee Rail-road the minimum radius is 1400 feet, and occurs but twice; both being at the crossing of heavy ridges, and at the same time stopping places; on the other sections of the lower route, there is no radius under 1900 feet.

Even the minimum radius of 1000 feet, will with proper attention to details, admit of a speed of 20 miles per hour, with perfect safety; and this may, without fear of error, be assumed as *the least average speed* of the passenger trains, on the lower route; one of from 25 to 30 miles an hour, could readily be attained if necessary.

Each section of the lower route also presents nearly the same maximum grade, varying in none more than 3 or 4 feet; the maximum rise, as before remarked, being but 36 feet in a mile. This uniformity will admit of extreme regularity in the business operations of the several sections.

The wonderfully favourable character of the lower route is incident on the fact, that it occupies a series of vallies, running parallel to the immense mountain barriers, which nature has stretched as if in defiance of the efforts of art, almost uninterruptedly, from New York to the northern parts of Georgia. At the latter point we are enabled to curve round their lower extremities, and thus reach the sea board without crossing them.

On the other hand, the upper route is necessarily carried *across* these barriers, and must therefore encounter the heavy grades incident upon approaching them, and either the deep cutting, inclined planes, or tunnels, required for overcoming their summits.

Again, certain portions of the upper route, such as the deep valley of the French Broad River, and various mountain passes of the Blue ridge; are annually obstructed for several weeks by snow, ice and frost. This will create serious, if not *insurmountable*, obstacles to regularity in the winter business; especially as the thinly scattered population of those parts, will not admit of the collecting of large forces of men to clear the road, as is frequently found necessary in the north.

On the lower route, ice and snow rarely occur at all; and *never* in sufficient quantity to cause a moment's interruption to rail-road traveling.

Again, the cost of the lower route will be so small in comparison with that

* There is, it is true, one inclined plane on the South Carolina Rail-road, a few miles from Augusta; it was incurred when that road was first constructed, to gratify the inhabitants of the little town of Aiken. The extension of the road, as now taking place, was not, at that time, thought of; and as the business incident on the extention gradually increases, the plane will no doubt be dispensed with. Fortunately this can be very readily done.

of the upper, that it will be absolutely impossible for the latter to maintain a competition with it. Thus we see that in point of all the desiderata of rail-road traveling, in speed, safety, certainty, and cheapness, the lower route is, by far, preferable to that selected by the Charleston and Cincinnati Rail-road Company.

I have been thus particular in comparing the upper and lower routes from Knoxville to Charleston, that I might with the more apparent reason, urge upon the advocates of the Charleston and Cincinnati Rail-road, the *immediate* construction of that portion of their road which lies *between Knoxville and Cincinnati.* The present intention of the company appears to be to construct the road gradually from Charleston upwards towards Knoxville, and thus on to Cincinnati; leaving, of course, the part between Knoxville and Cincinnati, some years behind the portion through South Carolina. Now it is very evident that a rail-road from Charleston, through the centre of South Carolina, even if it stop at the northern line of the state, will be of immense benefit to South Carolina, and particularly to Charleston; it will furnish an excellent communication between the interior of the state and her sea board; and this is very important to *her;* but is it important to the *stockholders?* Is it calculated to excite in Tennessee, Kentucky and the whole Union, the confidence which a rail-road from Charleston to Cincinnati was designed to effect? Why should a merchant, residing at a distance from the line, prefer a note of the South Carolina Rail-road bank, to that of any other rail-road; and into a mere South Carolina Bank must the whole scheme degenerate (at least for several years,) if the present intention be persisted in. And pray of what benefit is a line from Charleston to Knoxville to be at any rate, toward effecting an importing system, even supposing both the upper and lower routes to be completed thus far? Let us imagine for a moment that such were the case, and that the interval between Knoxville and Cincinnati remain as at present, traversed only by miserable common roads; can any man suppose that either route, or even their combined attractions, would operate to the value of one farthing, in diverting the trade of the "Great West" from along the Ohio river to the northern sea ports, and turning it towards Charleston? Can he suppose that one merchant more would come from Illinois, Indiana, or Ohio, in consequence of it? Assuredly not. What is to induce the western merchant to exchange the splendid and cheap accommodations, the speed and comfort of his steamboat as he passes up the Ohio, for a rough, unsafe and expensive stage ride of some 200 or 300 miles by day and night, at 2½ miles per hour to Knoxville? Is it the love of adventure, in risking his life over the perilous mountain passes of Kentucky and Tennessee? I trust not, yet can I conjure up no better reason.

I hesitate not to predict that if the Charleston and Cincinnati Railroad Co. delay the construction of their road from Knoxville to Cincinnati, until after the completion of the remainder, the trade of the Great West will have become so fixed in its channel of the Ohio, and the line of rail-roads before alluded to, parallel to that river, that the South will endeavour in vain to change it. Let her even *do her best,* the lines through Indiana, Illinois, Ohio, Pennsylvania and New York, will be completed before she can make the road from *Knoxville to Cincinnati.* What madness is it then to delay. While we are hesitating and discussing whether the upper or lower route *from* Knoxville to Charleston, be the better, we seem to forget that we have provided no means for bringing passengers and merchandize *to* Knoxville;

and while, like the wolf and the bear, we are disputing for the prey which lies before us, a third party steps in and carries it away from both.

The course pursued in this matter by South Carolina, upon whose movements the whole machinery of the scheme depends, is by some ascribed (it appears to us uncharitably) to an existing jealousy between her and Georgia; by which South Carolina is supposed to be actuated to such an extent, as to decline all interference in any project in which Georgia should take part; and consequently prefer making an expensive road through her own territory, to availing herself of one of far superior character, through her rival State. Thus we see the upper end of the Charleston and Hamburg rail-road, and the lower end of the Athens and Augusta rail-road, like the two ends of a horse-shoe magnet, (see map) exercising a repulsive influence on each other, which bids fair to neutralize the otherwise general and beneficial action of this noble scheme.

To us it appears that the policy for South Carolina would be to enter into an amicable arrangement with the various companies constituting the lower route from Knoxville to Charleston, (of which route she already possesses 136 miles, in the Charleston and Hamburg rail-road;) and then construct the line from Knoxville to Cincinnati. By concentrating all her energies upon this interval, she would beyond all doubt, enlist both Tennessee and Kentucky deeply in the enterprise; for to both of those States, it is one of great importance; but so long as the present policy of working from Charleston upwards through South Carolina, is adhered to, the benefits of the undertaking are far too prospective, to induce any active interference in its behalf, on their part.

To adopt the course we propose, would probably lose to the company the charter of North Carolina; as the line would, in that case, not enter her territory. But of what importance is that consideration? Of what benefit is the Charleston and Cincinnati rail-road to be to North Carolina, in any event? It passes only through one of her counties, and that her extreme western one, and of a most sterile and mountainous character. Surely that is not sufficient to induce a hope that North Carolina will render any important aid to the project; whereas in the other case, as before said, both Tennessee and Kentucky would assuredly assist it to a very efficient degree; for both these States would need it for the exportation of their live-stock and provisions to the cotton country; and that alone, independently of any considerations of a southern importing system, should be a sufficient guarantee of profit, to warrant the immediate construction of the road through those two States.

We cannot anticipate much difficulty in procuring from the Legislatures of Tennessee and Kentucky, permission so to alter the charter, as to admit of the changes we propose. Legislative bodies, like private individuals, are influenced by *interest;* convince them that their present course is detrimental to their interest, and they will assuredly change it.

Perhaps the greatest real difficulty in way of the change lies in the company itself, not being willing to have its concerns divided into two branches, as would be the case if our ideas of uniting the Charleston and Cincinnati rail-road with the *lower route*, should be carried into effect. The Charleston and Cincinnati rail-road Company would then own only the road already constructed from Charleston to Augusta, and that, yet to be commenced, from Knoxville to Cincinnati; the interval between Augusta and Knoxville being in possession, as already stated, of several distinct companies.

Could the Charleston and Cincinnati company purchase this interval from

the various companies now holding it, the difficulty would be at once removed; but we consider such an arrangement so utterly impracticable, that it is useless even to suggest it.

Great as the objection certainly is, to the division of the concerns of the Company, still it is obviously not an insuperable one. The case seems to us, nearly parallel to that of a merchant possessing flourishing business houses in two different cities.

Be that as it may, however, we cannot view the construction of the upper route from Knoxville to Charleston in any other light than that of a useless expenditure of money, unless it be looked upon as politic, to purchase the good will of the districts through which it passes, by circulating among them at the expense of the company, the sums requisite for its construction. Even if finished, *it can never sustain a competition against the superior merits of the lower route.*

We are somewhat surprised at the course pursued by Kentucky in relation to the Charleston and Cincinnati rail-road. She has lent no pecuniary aid to its construction, although she must necessarily derive great advantages from it. Her merchants will be provided with new markets for making their purchases; and the facilities for conducting her heavy exports will be greatly increased. The road will certainly not be made through Kentucky, unassisted by her pecuniary means; it is therefore to be hoped, not only on *her* account, but in a *national* point of view, that her opinions on the subject may assume a more favourable direction. We cannot but suppose that the adoption of the lower route, would lead to such a change, and enlist Kentucky strongly in the cause.

We have hitherto spoken principally of *Charleston*, as striving to carry out measures for diverting part of the trade of the west, from the northern to the southern sea ports, by means of her rail-roads; we must now speak of her enterprising and spirited rival, Savannah. In point of magnitude Charleston is greatly superior to Savannah, containing a population of 43,000; while that of Savannah is but 10,000. The principal distinctive feature however between the two cities, as regards their importing facilities, consists in the superior harbour of Charleston; which is, we believe, confessedly the best along the Southern Atlantic sea-board.

There will however be no means left unresorted to, for rendering that of Savannah, in every respect perfectly eligible, and this its natural position admits of the more readily, since constructions in that branch of engineering are no longer involved in the uncertainty, by which, until the discoveries of late years, they were characterized.

It will be perceived by the map, that Savannah is determined to be by no means behind Charleston, in her facilities of intercourse with the interior and north western States; indeed if Charleston persevere in her scheme of the upper route from Knoxville, and insist upon conducting her transportation along it, Savannah will have the advantage of a far superior road; which, in our opinion, will much more than counterbalance any disparity which may exist between their respective harbours.

On the map is marked a rail-road from Savannah to the city of Macon, near the centre of Georgia. This is the great *central rail-road of Georgia*; its length is about 200 miles. It is exclusively a company work. About 80 miles of it are already finished and in use; and the remainder is being rapidly progressed with. Like the lower route from Knoxville to Charleston, it is characterised by its unusually favourable features; and indeed the same remark may be applied to all the rail-roads in Georgia.

From the city of Macon the rail-road is continued to the town of Forsyth, by the Monroe rail-road, twenty-four miles in length; which will soon be (if it is not already) in operation.

From the city of Macon, is also to be constructed another rail-road to the town of Talbotton; at which point it will branch off into two lines: one to West Point, to meet the Montgomery and West Point rail-road; and the other to Columbus. Another branch from the Central rail-road is also being surveyed, through the town of Waynesborough to Augusta, by which a union will be effected with the lower route from Knoxville. It will be forty-eight miles in length. Thus it will be seen that Savannah possesses quite as favourable avenues to the interior, as Charleston does; and if a bridge be not built across the Savannah river at Augusta, by which the South Carolina rail-road may unite with the lower route from Knoxville, Savannah must receive the preference from western merchants. We are fully convinced that the want of a bridge at Augusta, and the selection of the upper route, by the Charleston and Cincinnati rail-road company, will do more to decide the question of superiority between those two rival cities, than any other consideration possibly can.

About 70 miles south of Savannah is the sea-port of Brunswick; at present a place of comparatively little importance; but destined, on account of its remarkably fine harbour, and its contemplated rail-road connexion with Savannah, to become in a short time one of the most important of the southern ports.

Besides these Atlantic ports, others on the gulf of Mexico, such as Appalachicola, Pensacola and Mobile will become termini of rail-roads from the interior; and will all be more or less similarly affected with Charleston, Savannah and Brunswick; with, however, this great difference, that the dangerous navigation of the Bahama banks at the mouth of the gulf of Mexico, which must be encountered in a voyage to, or from, Europe, will always keep them secondary to the Atlantic ports. As before remarked, we think this might be obviated by a ship canal across East Florida; or, more imperfectly, by a rail-road.

Appalachicola is at the mouth of the Appalachicola river, formed by the confluence of the Flint and Chattahoochie. The latter is navigable for steam-boats for 200 miles as far as Columbus; from which point, as indicated by the map, are lines of rail-roads to Cincinnati by way of Knoxville; and also to Savannah and Charleston. At this time, Appalachicola is but a small town; it receives considerable amount of cotton from the upper parts of Georgia, by way of the river, but its importance will be increased greatly by its rail-road connexions.

Similarly conditioned with Appalachicola, are Pensacola and Mobile. We have not in our possession, any very definite information respecting the rail-road from Pensacola to Montgomery; we believe however that some progress has been made in its construction. From Montgomery, or rather from Fort Mitchell, (a point some distance above Montgomery) to West Point, is a rail-road in a state of rapid progress. The reason for delaying the construction between Fort Mitchell and Montgomery is, that the river navigation between those places, although very circuitous, is sufficiently good for present purposes. The prolongation to Montgomery, will be made, as soon as the progress of the Pensacola rail-road, renders it advisable.

Through West Point passes also the Columbus and Chattahoochie rail-road, leading from Columbus, to the western and Atlantic rail-road, near

Decatur. This latter road will, like the Montgomery and West Point rail-road, be rapidly pushed forward to completion.

The intercourse of Mobile with the interior, will be both through the same channel as that to Pensacola, and also through the *Selma and Tennessee rail-road*, now under construction from the town of Selma to the Tennessee river, above Huntsville. This road is 170 miles in length. A branch is contemplated from near its upper terminus, along the valley of the Coosa river, to join the western and Atlantic rail-road, near New Echota. This branch will open to Alabama a communication to East Tennessee, by way of the Hiwassee rail-road, to Knoxville; and thence by way of the Charleston and Cincinnati rail-road to the Ohio; it is very important to all Alabama. We have heard of no contemplated branch from the Selma and Tennessee rail-road to Tuscaloosa; but such a one will assuredly soon urge itself upon the public notice, in that section. The harbour of Mobile bay at the town being too shallow for large ships, and gradually becoming worse, it has been found necessary to construct a rail-road 28 miles in length to Cedar Point on the gulf, where the largest vessels lie in safety.

From the town of Wetumpka, above Montgomery, a rail-road is in progress, along the Valley of the Coosa to Fort Williams; by which the obstructions in the river between those points, will be avoided. It is called the Coosa and Wetumpka rail-road; and will be extended to unite with the Selma and Tennessee rail-road, and with the lower route from Knoxville to Savannah and Charleston.

All these roads are constructed with the triple intention of expediting the carrying of cotton from the interior, to the several ports at which they terminate; of procuring provisions more readily from the agricultural districts of Tennessee and Kentucky, &c. and of effecting an *importing system in the South.* The rivers of the South, answer the purposes of intercommunication in but a very imperfect manner. In the summer they generally become unnavigable, for want of water. It is well known that the Ohio trade is interrupted more or less every summer, from this cause; but in the streams still further South, the deficiency is felt to a much more serious extent. Thus the Tennessee river, *even in the most favourable seasons* is rarely navigable for steam-boats, even of moderate draft, for more than two or three months in the year, as far up as Knoxville; and we have known intervals of very nearly a year to elapse, without a sufficient rise of water, for a single arrival. Pretty much the same, only not to so great a degree, may be stated of the river Cumberland, and the city of Nashville. The delays thus occasioned are extremely vexatious, and frequently productive of great inconvenience to the merchant.

We will remark while speaking of Nashville, that we expect soon to see her interesting herself in the construction of a rail-road, to meet the Western and Atlantic rail-road near Ross' landing on the Tennessee river. The Western and Atlantic rail-road, it will be seen by the map, branches into two lines, near its northern terminus; one going directly north, to meet the Hiwassee rail-road; and the other passing in a north-west direction, to the Tennessee river, near Ross' landing. A communication between the latter branch and Nashville, would relieve that city from the embarrassments of the obstructed navigation of the Cumberland. Such a road, in connexion with the Hiwassee rail-road, would constitute the best route between Nashville and Knoxville; it would be but a very few miles longer than the present stage road between those places. Its length would be about 100 miles.

Again, in order fully to perfect the importing system of the South, a ready communication is obviously necessary between her sea-board and the region west of the Mississippi river; as well as with the north-western States. Such a communication is in progress. It is marked on the map, extending from the upper terminus of the Selma and Tennessee rail-road, to Memphis on the Mississippi. Of this very important line, the portion between Decatur and Tuscumbia (43 miles) has long been in operation; and that from Lagrange to Memphis, constituting the Memphis rail-road, 50 miles in length, is in progress. The intervening spaces have not yet been commenced; but undoubtedly soon will be. It will be one of the most useful and lucrative lines in the Union. We look for much more of the Illinois trade with the Southern Atlantic ports to take this channel.

Before closing this paper, we cannot refrain from making a few remarks respecting Virginia and East Tennessee.

It is a common observation, that Virginia is behindhand in her internal improvements, and that she is not equalling her sister States in energy, and foresight. For ourselves we cannot subscribe to that opinion; the remark appears to us an unjust one. Virginia has already done much, and is still steadily progressing in a very extensive and costly system of improvements. To enumerate them would be foreign from our present purpose; we will only urge upon her the necessity of one more. We allude to a rail-road from either Winchester, or Richmond, passing through the State in a south western direction, through Wythe Court-house and Abington, to meet an extension of the Hiwassee rail-road, at the Tennessee line near Blountville. This will form part of the *shortest and most eligible route from Maine to New Orleans, that can be obtained in the Union.*

Surveys have been made for the line from Richmond, and were favourably reported on; but unfortunately the requisite appropriations were not made for prosecuting the work. There can, however, be little doubt that the efforts which will be renewed at this session of the Legislature, will be successful. We consider the question one of immense interest to Virginia. Her fertile and far famed valley has long been retrograding, for want of an outlet to markets, which would permit it to enter into competition with more successful candidates.

This portion of Virginia has depended very much for sales of produce, upon travellers, and upon the wagoners who haul into the interior the merchandize purchased in the northern cities. The traveling has gradually been diverted into other, and better, channels; and even the hauling of merchandize, is at the moment we are writing, about to give way to more expeditious and economical channels opened by the rail-roads, constituting part of the lower route from Knoxville to Charleston; and which is now finished from Charleston northwards, upwards of 200 miles. By this route goods may be shipped from the northern cities to Charleston, and thence forwarded by rail-roads and wagons to East Tennessee, at a less expense than they can be hauled far across the valley of Virginia. No further reasoning is necessary, (though much more could be adduced) to convince Virginia of the necessity of prompt measures in relation to this road. Tennessee will readily co-operate with her, by filling up the interval between Knoxville and Blountville; and thus open an *uninterrupted line of rail-road from Maine to New Orleans.*

In East Tennessee, the reader will perceive that the Hiwassee rail-road occupies a position peculiar to itself, and one of the utmost importance to all interested in it; viz. it is at the same time a portion of the great line

from the N. E. to the S. W.; and of that from the S. E. to the N. W.; in other words, it is the *great cross road of the union.*

The numerous mountain ranges which occupy the region extending for 200 miles on each side of it, forbid the construction of a rival road; and ensure to the Hiwassee rail-road two sources of income, either of which would alone be sufficient to warrant its construction.

This is the case, we believe, with no other rail-road in the country; and it offers to the stockholders, the best inducements to believe in the full success of their project.

We must now call the attention of capitalists and farmers, to the eastern section of Tennessee. We are certain we are within bounds, when we say that no portion of our Union presents more flattering prospects of a profitable investment in every department of manufactures and agriculture, than East Tennessee.

She is the *nearest competitor* to the cotton growing country, in the sale of provisions and stock; her fertile vallies ensure abundant returns to the husbandman; her delightful climate is the most healthy in the Union; avoiding alike the extreme warmth of the South, and the extreme cold of the north. Her mineral resources of iron, lead, lime, gypsum, salt, coal, marble, &c. are inexhaustible. Her water power is unlimited and scattered over every part, to a most unusual degree; and finally a dense population is ready to insure success to the establishment of every kind of manufactory, and full employment to the mechanic in every department.

East Tennessee has hitherto held a peculiar position; hemmed in on all sides by mountains which almost preclude access, her merits have been overlooked. In other parts of the Union she is almost unknown; we may freely venture to say that no portion of the Union is so little known to all the others, as East Tennessee; yet she occupies the very centre of them all. The same cause which has operated so powerfully to retard the growth of Charleston and Savannah, has exerted the same influence on East Tennessee, viz. *the want of good roads.*

These she is now engaged in making; and in a very few years she will burst upon the notice of her sisters, with almost as strong claims to novelty as a newly discovered country. JOHN C. TRAUTWINE.

Knoxville, Nov. 1838.

Note—The above is to be regarded as but a very cursory and imperfect sketch of the Southern Improvement System. Our object being merely to lay before the reader, some of its most important bearings.—*The Writer.*

Tables, from a work about to be published, by E. H. Gill, Civil Engineer.

TABLE OF THE DISCHARGE OF WATER THROUGH IRON PIPES.

(Calculated from Eytelwein's Formula.)

	Head 5 feet; length 100 feet.		Head 10 ft; length 100 feet.		Head 20 ft; length 100 feet.	
Diameter of pipe in inches.	Velocity of water in feet per second.	Discharge in cubic feet per minute.	Velocity of water in feet per second.	Discharge in cubic feet per minute.	Velocity of water in feet per second.	Discharge in cubic feet per minute.
3	5.27	15.49	7.45	21.99	10.54	30.96
4	5.95	30.52	8.41	43.14	11.90	60.66
5	6.57	54.59	9.31	77.36	13.17	109.02
6	7.07	88.26	10.	117.78	14.14	166.26
7	7.50	118.89	10.61	168.18	14.99	237.42
8	7.92	167.50	11.20	236.88	15.84	334.50
9	8.25	218.64	11.67	309.27	16.51	436.80
10	8.51	276.23	12.11	393.09	17.13	556.02
11	8.87	353.74	12.55	500.51	17.75	707.16
12	9.12	429.76	12.90	607.89	18.25	859.56
13	9.36	514.42	13.24	727.66	18.72	1028.82
14	9.60	619.25	13.58	875.98	19.21	1239.
15	9.80	721.53	13.86	1020.45	19.61	1443.66
16	10.	833.52	14.13	1177.75	19.99	1665.96
17	10.18	967.26	14.40	1368.22	20.37	1934.70
18	10.35	1097.36	14.63	1551.15	20.70	2194.56
19	10.50	1235.17	14.85	1746.89	21.	2469.60
20	10.66	1400.97	15.08	1981.87	21.33	2802.72
21	10.80	1558.56	15.27	2203.64	21.60	3116.88
22	10.93	1724.88	15.45	2438.19	21.86	3449.46
23	11.06	1921.25	15.64	2716.85	22.13	3843.96
24	11.18	2107.38	15.81	2980.11	22.36	4213.92
	Head 10 feet; length 1000 feet.		Head 20 ft: length 1000 feet.		Head 60 ft; length 5000 feet	
3	2.48	7.29	3.51	10.31	2.49	7.32
4	2.85	14.53	4.03	20.55	2.88	14.68
5	3.20	26.49	4.53	37.51	3.23	26.74
6	3.49	42.78	4.93	56.20	3.52	40.12
7	3.75	58.50	5.30	82.68	3.79	59.12
8	4.02	84.42	5.69	107.49	4.07	85.47
9	4.25	112.20	6.01	158.66	4.31	113.78
10	4.47	144.82	6.31	204.44	4.53	146.77
11	4.69	185.72	6.63	262.54	4.77	188.89
12	4.88	228.41	6.90	322.92	4.91	229.78
13	5.05	276.27	7.15	390.39	5.17	282.28
14	5.26	337.89	7.43	477.	5.38	345.39
15	5.42	396.74	7.66	560.71	5.56	406.99
16	5.58	462.02	7.89	653.29	5.71	472.78
17	5.76	546.04	8.14	777.67	5.91	560.26
18	5.90	623.04	8.35	881.76	6.08	642.04
19	6.06	712.65	8.55	1005.48	6.23	732.64
20	6.20	814.68	8.77	1152.37	6.40	804.96
21	6.34	912.96	8.97	1291.68	6.55	943.20
22	6.49	1024.12	9.15	1443.87	6.70	1057.26
23	6.62	1167.90	9.36	1623.02	6.85	1187.79
24	6.74	1269.81	9.53	1795.45	7.	1380.80

DISCHARGE OF WATER THROUGH OPEN CANALS.

	Bottom 6 feet wide, top 12 feet, and depth 2 feet.		Bot. 10 ft wide, top 16 ft, depth 2 ft.	
Descent.	Velocity in feet per second.	Discharge in cubic feet per minute.	Velocity in feet per second.	Discharge in cubic feet per minute.
1 foot in 5000 feet	1.51	1631.88	1.59	2489.76
2	2.17	2353.32	2.3	3588.
3	2.69	2907.36	2.84	4430.40
4	3.12	3375.	3.29	5141.76
5	3.50	3787.56	3.69	5768.88
6	3.85	4160.16	4.06	6335.16
7	4.16	4502.52	4.39	6856.20
8	4.46	4821.12	4.70	7341.36
9	4.74	5120.28	4.99	7796.88
10	5.00	5404.32	5.27	8227.44
	Bottom 6 feet wide, top 18 feet, and depth 4 feet.		Bot. 10 ft wide, top 22 ft, depth 4 ft.	
1 foot in 5000 feet	2.01	5808.96	2.13	8198.40
2	2.89	8337.6	3.06	11761.92
3	3.57	10284.48	3.77	14496.
4	4.13	11920.32	4.37	16803.84
5	4.63	13343.04	4.90	18835.20
6	5.09	14667.84	5.38	20670.72
7	5.51	15868.80	5.82	22360.32
8	5.89	16983.36	6.23	23934.72
9	6.26	18034.56	6.61	25409.28
10	6.60	19028.16	6.98	26807.04

Sketch of the Tunnel now under construction upon the Chesapeake and Ohio Canal, at the Paw-paw bend of the Potomac River, by Ellwood Morris, Prin. Assis. Eng. January 1st, 1839.

This Tunnel was adopted to avoid a circuitous navigation of six and a half miles and some very expensive work at the pass of the Paw-paw Ridge.

Of this six and a half miles the U. S. Engineers in their celebrated report on the Chesapeake and Ohio Canal (Ex. doc. No. 10, 19th Congress 2d sess.) speak in these words: "In approaching the neighbourhood of Paw-paw Ridge, the difficulties gradually increase until they reach an extent that is truly formidable, and will require all the resources of art successfully to overcome them."

Although their distinguished engineers did not, in their report, recommend a Tunnel through the Paw-paw Bend, to avoid the difficult passage around it, yet Lt. Col. Abert (now Col. and Chief of the U. S. Top. Eng.) who directed the surveys upon the Potomac, marked upon his map of the pass of the Paw-paw Ridge, a Tunnel line which he recommended to be examined before finally deciding upon the plan of this division of the canal.

These considerations emanating from such high authority, induced a careful instrumental survey of the pass; which resulted in the development of a Tunnel route, immediately at the gorge of the bend, cutting off about two miles more distance than would have been done by the line indicated by Lt. Col. Abert.

This route as finally laid down (by C. B. Fisk, Esq., Chief Engineer of the

Canal) in June, 1836, gives a Tunnel of 3118 feet in length, and measures from river to river one and a half miles, while the distance around the bend (by a location made for the canal, previously to adopting the tunnel route) is six and a half miles; thus making a clear saving of five miles.

The length of the tunnel, as above stated, is 3118 feet, the highest summit of the ridge under which it passes, 362 feet above the bottom of the canal, (see fig. 1) and the material a hard blue slate rock.

It is (if I am correctly informed) the longest tunnel yet undertaken for any road or canal in North America; though many of greater magnitude have been constructed in Europe.

Its transverse section as cut, is twenty-seven feet extreme width, by twenty-five and a half feet extreme height. But when finished it will not (on account of the arch) present so great a section; (see fig. 2.)

The Tunnel is wrought in *two* sections or breasts; 1st, The *Heading*, the floor of which is level, twelve and a half feet below the top of the excavation. 2d, The *Bottoming*, which is a thorough cut, thirteen feet deep, (see figs. 1 and 3.)

The heading is driven in advance, and the bottoming excavated subsequently, leaving for the present a ledge on the towing path side, eight feet in width, on which a rail-road is laid down to carry out the excavated material. A similar rail-road is laid upon the canal bottom, which performs the same office for the rest of the work. Both roads are worked by cars and horses, and have upon the spoil bank an apparatus which unloads the cars by tilting, with very little trouble.

The Southern deep cut being comparatively light, was bottomed out in fourteen months; it was begun in August, 1836, and was so far excavated in June, 1837, as to enable the tunnel heading to be begun, which was accordingly commenced, and ten lineal feet were driven in that month.

Since that time (June 1837) the working from this portal has been prosecuted day and night without intermission (Sundays excepted.)

The northern deep cut being very heavy and requiring a long time to reduce it down to canal bottom, or even to the heading level, it was found necessary to sink shafts, in order to expedite the excavation of the tunnel: and for this purpose two double shafts (each eight feet in diameter and fifteen feet clear apart) were sunk: viz, shafts A and B, 122 feet deep; C and D, 188 feet deep, (see fig. 1.)

These shafts were sunk in pairs to facilitate the ventilation and give opportunity for employing a double hoisting apparatus to free them from water, and remove the materials excavated. Both of which are hoisted out by one-horse gins, one to each shaft; the horses being changed every eight, and sometimes in wet weather, every six hours.

The tunnel is now working at five points, viz: from the south portal, and *both* ways from *each* of the shafts, (see fig. 1.)

In driving north from the south portal, and south from shaft D, the work is carried on day and night (Sundays excepted) by three shifts of miners, each working eight hours out of twenty-four; and progresses, taking both workings together, at the rate of about seventy feet per month.

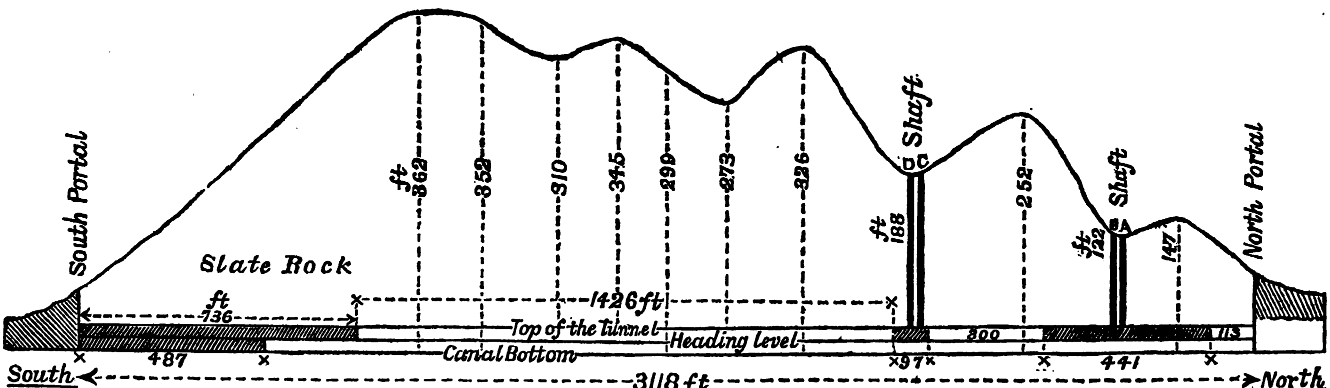
In the other shaft workings (a less distance being to drive from them) only two shifts of miners, or sixteen hours out of twenty-four, are at present wrought, making from each working about twenty-five feet monthly.

Owing to the large amount of rock excavation in the north deep cut, although it was begun in July, 1836, and has therefore been thirty months in hand, the tunnel will not be fairly opened at its northern portal before June

LONGITUDINAL SECTION OF THE TUNNEL, JANUARY 1st, 1839.

Magnetic Course of the Tunnel in 1836, *N* $6\frac{1}{2}°$ *E.*

Fig. 1



Scales. { Horizontal 500 ft. to the inch. / Vertical 200 do. do. } Heading driven = 1274 ft. lineal. / Do. to be done = 1844 do. } The shaded parts show what has been excavated: / The blank parts that which remains to be done.

Note.—The whole course of the Tunnel consists of slate rock (in inclined strata sometimes contorted) of a bluish gray colour, containing considerable lime and occasional veins of shell limestone.

1st, 1839, by which time the heading working north from the shaft A, (fig. 1) will be driven out to meet the open cut.

The two shafts, B and C, will also, by that time, be connected, and there will then remain about 1000 feet lineal of the heading to be driven between shaft D and the south portal.

The water of the canal through this tunnel will be seven feet in depth, the towing path for horses, six feet in width, and the headway of the tunnel clear of the water surface will be seventeen feet, (that being the height established on this canal for bridges, &c.)

The material through which this work is carried, is of a consistency, in general, quite equal to sustaining itself and carrying all the weight above it; yet in all probability from its slaty nature it would, if exposed and unprotected, yield in the course of time to the destructive action of atmospheric changes.

It is therefore contemplated to protect the interior by a lining of brick in the arch form, either one or two bricks in thickness. An arch of one brick (nine inches) thick, would doubtless answer the purpose, and will probably be employed.

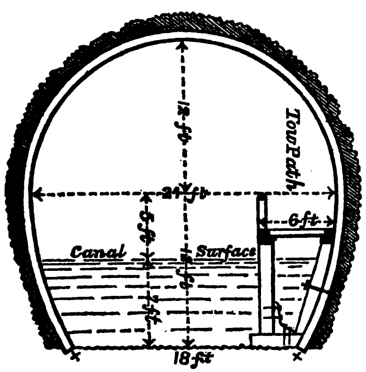
The present plan contemplates forming the tow path by a continuous wooden bridge open below, so as to allow the water to flow under and fill the whole water section of the tunnel, (see fig. 2.)

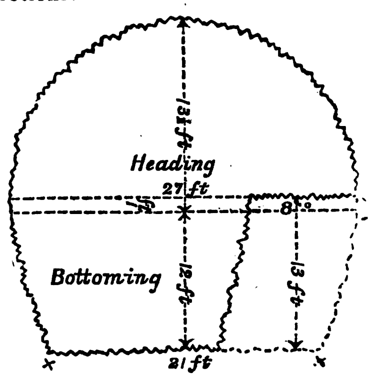
The workings so far have been as free from water as could reasonably be expected, the mean flow at present being at the foot of the shafts C and D near one and a half cubic feet per minute, at shafts A and B about one quarter of a cubic foot per minute, (all of which is hoisted out by the horse gins) and at the south portal about one cubic foot per minute, which drains off by the canal bottom. Thus making the entire flow of water about two and three quarter cubic feet per minute.

Owing to the arrangement of double shafts, the ventilation has always been good.

Fig. 2. Fig. 3.

Transverse Sections.





Scale 15 feet to the inch.

Physical Science.

Notice of Prof. Struve's *Micrometric Measures of double and multiple stars, with the great Dorpat Refractor, in the years from* 1824 *to* 1835. By Sears C. Walker.

On the occasion of the recent visit of Mr. Holcomb to Philadelphia to place in the Exhibition of the Franklin Institute, one of his seven feet Herschelian reflectors, I was informed by that meritorious artist that γ Virginis, from having been perfectly single with the highest powers in his fourteen feet reflectors from 1833 to 1836, has since undergone such a change as to be readily divided with a ten feet reflector. Mr. Holcomb also remarked that η Coronæ is now closer and more difficult to be divided than 36 Andromedæ. He has, on two occasions, separated η Coronæ; not, however, so completely as to make the discs tangent to each other. This was effected with a fourteen feet reflector under highly favourable atmospheric circumstances. 36 Andromedæ he has, with a ten feet reflector, recognised to be a double star. Both η Coronæ and 36 Andromedæ, were in 1830 pronounced, by Sir John F. W. Herschel, to be exceedingly close and difficult to divide (the former of them more so) even with his twenty feet reflector. That Mr. Holcomb, in the interior of New England, almost without assistance, should have carried the art of polishing specula to such a degree of perfection as to detect a variation in the distance of two pairs of stars so close as η Coronæ and γ Virginis, is somewhat surprising, and certainly without a parallel in this country. To test the correctness of Mr. Holcomb's remarks, I examined the British publications on this subject. The opening of γ Virginis is quite in conformity with Sir John F. W. Herschel's predictions previous to his departure for the Cape of Good Hope. Their nearest approach appears, by his elements of their orbit, to have taken place in 1835.5; their distance at that time should have been 0.″79, and their present distance 1.″6 which would confirm Mr. Holcomb's observations. As I could not find any recent English measurements of η Coronæ, recourse was had to Prof. Struve's measurements published in Schumacher's Astronomische Nachrichten. These show that the two stars of η Coronæ which were 1.″0 distant in 1836, were only 0.″7 in 1835.4, and were still approaching each other. Their distance at this time is 0″.5, and again the observation of Mr. Holcomb is confirmed. As there are several reflectors of 7, 10, and 14 feet focal length by Holcomb and Son now in the possession of individuals and colleges, I have thought that it would be useful to give in an English dress some of the most remarkable facts concerning double revolving stars, contained in Struve's announcement of the work of which the title translated from Latin to English is placed at the head of this notice. Previous to this it is proposed to give a short notice of the best telescopes now in use.

The great reflector mounted at the Dorpat observatory in 1825, is a lasting monument of the genius of Joseph Fraunhofer. Its focal length is 13.3 feet, and its clear aperture 9.6 English inches, being one-third larger than that of any achromatic reflector that had hitherto been made. The testimony of its proprietors, as well as of every astronomer who has visited Dorpat, shows that this instrument surpasses all other equatorial refractors previously erected, as much in the mechanical skill displayed in its mounting,

as in its optical capacity. The early death of the great optician who constructed it cannot be too much lamented. The loss to science has fortunately not been irreparable. His surviving partner, J. Von Utschneider, whose wealth enabled Fraunhofer to prosecute his optical discoveries, still retains the art in its greatest perfection. Another instrument, the fellow of the Dorpat refractor, has, since the death of Fraunhofer, been completed by Utschneider for Prof. Encke, at the Berlin Observatory. With it that celebrated astronomer has recently proved the existence of a second division of the ring of Saturn, which had been stated before, but without sufficient confirmation, by Capt. Kater and others. An improvement in the mounting of Encke's Equatorial over even that of the Dorpat, has been introduced through the mechanical contrivance of Mr. Mahler. This enabled Encke, on the first re-appearance of the comet, which bears his name, in September last, to determine its place by simply bringing the comet to the centre of the field, and reading the graduation on the hour and declination circles. Two other refractors of 15 feet focal length, and 11.2 English inches aperture, have been made at the same establishment, the optical part of which is under the direction of Mr. George Merz.

With one of them lately mounted at the Bogenhausen Observatory in Munich, the Director, Mr. Lamont, has observed the sixth Satellite of Saturn and the third Satellite of Herschel, neither of which had been observed by any other astronomer living, the 20 feet reflector of Sir John Herschel having proved inadequate to the task. Another refractor of 23 feet focal length and 15.3 English inches aperture was ordered in 1834, by Struve, for the Central Observatory of Pulkova, near Petersburg, at an expense of 76,000 roubles, [$16,000.] This instrument was partly finished when Pres. A. D. Bache visited Munich in the spring of 1838. A letter just received from George Merz, by Mr. Geo. M. Justice, states, in excuse for the delay in completing the instruments ordered for the Philadelphia Observatory, that this great refractor, and a smaller one of 9.7 feet length and 7 inches aperture mounted as a heliometer, have just been completed after four year's labour. The Pulkova refractor, though inferior perhaps in optical capacity to Sir William Herschel's 40 feet reflector, will far surpass it in precision of measurements.

Two refractors of 19 feet focal length, and 11.8 inches aperture, in the possession of Sir James South, and of the Cambridge Observatory, are the workmanship of M. Cauchoix of Paris. An imperfection in the mounting of the former by Troughton and Simms, and a protracted law suit consequent thereon, has deprived the world of the valuable labours of Sir James South. The Cambridge refractor is not yet mounted. There is however a refractor by Cauchoix second only in power to the great Pulkova refractor, in the possession of Mr. Cooper of Ireland. This equatorial mounted at that gentleman's observatory is twenty-five English feet in length, and 13.3 inches aperture. Though superior in dimensions to the Bogenhausen refractor, there are few published observations with Cauchoix's refractors that indicate a superiority in optical capacity. On the contrary the two observations of Lamont already alluded to are almost without a rival in the nineteenth century. I should have stated that they are wholly without example, but for the recent observations said to have been made by P. De Vico, at the Roman College, Rome, with a telescope which its maker, Cauchoix, states, Astr. Nachr. 305, to be of the same size as that of the Transit instrument made by him for the Paris Observatory. P. De Vico is said by Dumouchel, Astr. Nachr. 357, to have seen six rings of Saturn on several evenings, and in the course of

the summer of 1838, all of the seven satellites of Saturn. As the seventh or innermost satellite has not been seen this century by the most powerful telescopes in use, this discovery, if authentic, while it affords the most remarkable testimony in favour of Cauchoix's telescopes, shows also that the serenity of the sky of Italy is such as to set aside the distinctions of optical capacity of telescopes that prevail in more northern climates.

It is worthy of remark, that the star or rather the stellar system η Coronæ, already mentioned, furnishes a singular test of the comparative excellence of telescopes. Mr. Holcomb speaks of the two stars of η Coronæ the principal and its companion. It is evident that the telescopes he has yet made are not adequate to the exhibition of a second companion or satellite. Sir John F. W. Herschel has, with his twenty feet reflector, seen this second companion, with a power of 300. As no mention is made of it in Struve's notice of his *mensuræ micrometricæ*, where repeated measures of distance and position of the first are given, it is clear that the Dorpat refractor is too small to exhibit this second companion. It has however been observed by Lamont, and its distance and position carefully measured—another instance of the wonderful power and precision of measurement afforded by the Bogenhausen refractor, as Sir John F. W. Herschel had only determined these quantities by conjecture. Mr. Lamont has also determined the distance and position of the small companion of α Cancri of the twentieth magnitude. Sir John F. W. Herschel remarks that this small star is nearly equal in lustre to the largest of the satellites of Herschel, and that "no telescope is adequate to show the latter which does not also exhibit the former.

To return to the subject of Struve's micrometric measurements—these contain the result of the arduous labours of that indefatigable astronomer since 1824. Some idea of their magnitude may be formed when we are told that they amount to 10,500 observations, counting for a single one the entire set of observations of a double star made in a single day even when often repeated. These have been portioned out among 2707 pairs of stars, of which none have been observed less than twice. In making them, Struve used a spider line micrometer visible in an illuminated field. For very faint stars he used an invention peculiar to Fraunhofer, by which the lines are made luminous in a dark field, without concealing the faintest objects from view. It does not appear that any British artists have succeeded in imitating this illuminated line micrometer. Hence many observations of comets, nebulæ and faint double stars have been omitted, or their place supplied by conjecture, which this invention would have furnished. I am informed by Pres. A. D. Bache that an inconvenience occurs in the present mode of arranging these micrometers, viz: that the spider lines are only illuminated on one side, requiring a correction to be applied for the observed transit over the line.

Many of Struve's measurements of the brighter double stars were made in the day time. The powers used were from 320 to 1000. The value of a turn of the micrometer screw, was 15.″315. The screw was sub-divided into 100 parts, thus reading to 0.″153; or (since the tenth part of a division could be easily distinguished) to 0.″0153. The position circle had two verniers each reading to a single minute.

In 1827 Prof. Struve published his *Catalogus novus*, or new Catalogue of double and multiple stars. In 1836 he announced his *Mensuræ Micrometricæ*, a work of which the title is placed at the head of this notice. It is published by the Imperial Russian Academy, and contains a complete re-

view of the double stars visible at Dorpat to the number of 2622, whose distance asunder is less than 16″. The angles of position reckoned from the north in the declination circle eastward round the circle, are given for different dates, and their distances, magnitudes, right ascensions and declinations are also stated. These singular pairs and multiples of stars thus given for a particular epoch in position, bearing, apparent distance and magnitude, with an accuracy hitherto unattained by any other astronomer, will remain for ages the subject of observation, and comparison.

It has not been the object of Prof. Struve to compute the orbits of double stars; but to furnish a general review of the heavens so that others may be guided in their selection of the proper objects of research.

The number of stars known to revolve round each other was stated by Sir John F. W. Herschel 1831 to amount to about 40, of which the elliptical elements of nine pairs, computed chiefly by himself, are given in his astronomy. His observations at the Cape have added to the number, and there can be no doubt that the *Mensuræ Micrometricæ* of Struve will serve to increase it. The attention of astronomers is particularly called to twenty-eight of the most remarkable pairs, and triplets of these stars in his paper, published in the Astronomical Notices No. 304; of these it is proposed to furnish a list, with occasional references to the more recent results obtained by Dr. Mädler, of the Berlin Observatory.

423 Atlas Pleiadum R. A.; 3h. 38.9m., Dec. + 23° 30′.

These difficult double stars were measured once in 1827. They were seen elongated in 1830. Since then there has been no trace of the companion.

*1356 ω Leonis H. 1.26. R. A., 9h. 19.0m., Dec. + 9° 50′ mag. 6.2 and 7.0.

Epoch.	Distance.	Direction.	Days of Observation.
1782.87		110°.90	
1804.09		130 .88	
1825.21	0″.970	153 .94	5
1832.25	0 .515	163 .40	2
1833.29	0 .447	172 .80	3
1835.33	0 .3	177 .40	3

From these it appears that the motion is direct. Probably these stars passed their aphelion between 1804 and 1825. In 1804, they were four times as distant as in 1782, and twice as distant as in 1795. In 1836 and 1837 the two stars should have ceased to appear double in any telescope. Shortly afterwards the companion was expected to emerge on the other side.

* On examining this very close pair of stars, with the 7 feet Herschelian by Holcomb on the 8th of January, 1839, an evening remarkable for its serenity, I was induced to believe that the companion has already emerged, as was anticipated.

1670 γ Virginis, H. 3.18, R. A., 12h. 32.8m. Dec. — 0°.29, both of 3d mag.

1825.32	2″.373	277°.92	6	Struve.
1828.38	2 .070	271 .50	1	"
1829.39	1 .782	268 .28	5	"
1831.36	1 .492	260 .92	5	"
1832.52	1 .262	253 .50	4	"
1833.37	1 .056	245 .53	7	"
1834.38	0 .912	231 .66	5	"
1834.84		214 .60	1	"
1835.38	0 .514	195 .48	9	"
1836.41	0 .257	151 .57		"
1837.20		100 .42		Encke.
1837.41	0 .595	78 .12		Struve.
1837.48	0 .626	76 .40		Encke, Galle, Mädler.
1838.41	0 .867	52 .03		Struve.
1838.42	0 .768	50 .65		Otto, Struve.
1838.43	0 .830	49 .20		Galle, Mädler.

These two stars are variable in brightness, sometimes one, sometimes the other, appearing the brighter. The direction of these stars was noted by Bradley in 1718, and by Mayer in 1756. During this century they have revolved through more than half their orbit, and have diminished their distance from 6″.5 to 0″.3, and are again receding. Herschell II's period of revolution, 660 years, appears no longer tenable. Mädler, in the Astr. Nachr. 363, finds the period to be nearly 160 years.

1728 42 Comæ Berenices R. A., 13h. 1.6m., Dec. + 18° 28′, both 6th mag. One is however smaller than the other and is somewhat yellow.

1829.40	0″.640	11°.6
1833.37	single	
1834.45	elongated	228 .3
1835.39	0 .3	191 .2

From which it appears that one has retrograded upon the other, through 180°.4 of its apparent orbit, in 5.99 years. Between 1829 and 1835 a central occultation of the two stars has taken place. They were readily divisible in 1827, 28, 29, with a power of 600. In 1833 they remained single and perfectly round with a power of 1000.

1937 η Coronæ H. 1.16. R. A. 15h. 16.1m., Dec. + 30° 36′.

1826.77	1″.075	35°.28	4 days.
1829.55	0 .960	43 .25	2
1831.63	0 .883	50 .63	3
1832.76	0 .790	56 .87	3
1835.42	0 .732	74 .75	7
1836.52	0 .563	88 .77	

Period of their orbit 43 years, in 1835, still approaching each other. In 1838.5, distance 0.″507, according to Mädler's Ephemeris Astr. Nachr. No. 354.

1967 γ Coronæ, R. A. 15h. 35.5m. Dec. + 26° 52′.

These two stars of the 4th and 7th magnitude, present an example of a complete central occultation.

1826.75	0″.725	111°.05	2 days.
1828.98	0 .540	110 .7	3
1832.21	0 .4	102 .7	3
1833.34	0 .4	105 .8	2
1835.44			

Three trials on different days with a power of 1000, under favourable circumstances, showed them single without the slightest variation from the circular form.

2055 λ Ophiuchi H. 1.83. R. A. 16h. 22.1m., Dec. + 2° 22′. 4.0 and 6.1. mag.

The measures of the elder Herschel and of Struve give

1783.18		75.°4	
1802.39		69. 32	
1825.51	0.″837	331. 80	3 days.
1828.51	0. 813	342. 10	3 "
1831.90	1. 043	349. 47	3 "
1834.42	0. 987	350. 60	2 "
1835.55	0. 996	352. 48	5 "

As the first observations do not conform with each other, if we change the direction of the first by adding 180° it will appear probable that these two stars revolve round each other in a period of less than 40 years.

2084 ζ Herculis — H. I. 36. R. A. 16h 34.8′, Dec. + 31° 55′, 3.0 and 6.5 mag.

This wonderful pair of stars has, in a period of not more than 6 years, exhibited the phenomenon of the disappearance of the companion and its re-appearance on the other side of the principal star.

The measures of the elder Herschel and of Struve are,

1782.55	D	69.°3		
1795.	smaller than D	between 0° and 90°		
1802.	the star is single.			
1826.63	0.″910	23.°40	5 days.	
1828. 1829. 1831.	The star is single under the most favourable circumstances, with the greatest magnifying powers.			
1832.75	0.″81	220.°5	1 day.	Struve.
1834.45	0. 910	203. 5	2 "	"
1835.55	1. 094	197. 1	5 "	"
1836,58		188. 02		Mädler.
1836.60	1. 090	186. 30		Struve.
1838.70	1. 350	168. 50		Galle.

The only hypothesis that will reconcile all these observations is that of an orbit of about 14 years duration. Whether this is correct or not must be decided by future observations. Such was the opinion of Struve in 1836. Dr. Mädler, in Astr. Nachr. 363, finds a period of 36.3375 years as the result of the more recent observations.

2262. τ Ophiuchi = H. I. 88. R. A. 17h 53.4m. Dec.—8° 10′

This pair which, in 1783, Herschel pronounces to be the closest of all the double stars, exhibited, ten years ago, the opposite phenomenon of that which γ Coronæ, and ω Leonis have presented. In 1825 Struve could see no trace of the companion. In 1827 the star appeared elongated. In 1835 on six different days they appeared as two small stars of 5.th and 5.5 magnitude in contact with each other. Their centres were 0.″35 asunder, the mean angle 256.°7:

3062 = H. I. 39. R. A. 23h 57.1m, Dec. + 57° 28′. Mag. 6·9 and 8.0.

The elder Herschel's and Struve's observations give;

1782.65		320.°7	
1823.81	1.″25	36. 7	
1831.71	0. 820	87. 5	2 days.
1833.71	0. 557	108. 57	3 "
1835.66	0. 420	132. 62	5 "
1836.61	0. 466	146. 38	

The motion of the companion is direct and amounts to 65° in the last 3.95 years. The period cannot yet be determined. Future observations will be necessary to show whether the companion, between 1783 and 1823, revolved through 76° or 436° of its orbit. This was Struve's opinion in 1835. Dr. Mädler, Astr. Nachr. 344, finds a period of 84.5140 years.

1196. ζ Cancri = H. I. 24 et 111. 19. R. A. 8h 2.1m, Dec. + 18° 10′
A. 5.0, B. 5.7, C. 5.5 mag.

A. and B.					A. and C.				
1826.22	1.″140	57.°63	3	days.	1826.22	5.″300	154.°67	3	days.
1828.80	1. 040	38. 45	2	"	1828.99	5. 313	151. 38	3	"
1831.28	1. 048	29. 80	6	"	1831.28	5. 402	148. 57	6	"
1832.28	1. 150	27. 52	4	"	1832.28	5. 520	148. 60	4	"
1833.27	1. 147	22. 10	3	"	1833.27	5. 470	147. 60	3	"
1835.31	1. 136	20. 12	5	"	1835.31	5. 318	145. 44	5	"

1523. ξ Ursæ majoris. = H. 1.2 R. A. 11h 8.8m, Dec. 32° 30.

1826.20	1.″748	238.°75	3 days.
1827.27	1. 715	228. 27	4 "
1829.35	1. 671	213. 59	7 "
1831.44	1. 706	203. 82	5 "
1832.41	1. 750	195. 94	5 "
1833.38	1. 695	188. 24	5 "
1834.44	1. 875	184. 10	2 "
1835.42	1. 764	180. 18	5 "

1938. P. XV 74 prope μ Bootis = H. 1.17. R. A. 15h 18.0m, Dec. + 37° 56′.

1826.77	1.″385	327.°00	2 days.
1829.73	1. 243	324. 05	2 "
1833.85	1. 190	319. 17	3 "
1835.55	1. 103	318. 63	3 "

The stars are still approaching each other.

1998. ξ Libræ = H. 1. 33. et II. 20. R. A. 15h 54.7m Dec. — 10° 53′.

The observations of the elder Herschel and Struve, give

A. and B.				$\frac{A. + B.}{2}$ and C.			
1782.36		187.°94		1782.36		88.°62	
1825.47	1.″147	355. 97	3 days	1825.48	6.″750	78. 60	4 days.
1832.00	1. 225	4. 15	2 "	1832.00	6. 670	76. 75	2 "
1833.91	1. 240	5. 85	2 "	1833.91	6. 965	75. 20	2 "
1835.00	1. 235	7. 30	2 "	1835.00	7. 020	75. 40	2 "

2032. σ Coronæ = H. 1.3. R. A. 16h 7.9m, Dec. + 34° 20′.

1827.02	1.″312	89.°35	4 days.
1830.11	1. 220	104. 90	3 "
1832.99	1. 297	118. 80	3 "
1835.50	1. 308	130. 46	5 "

1757. P. XIII. 127. R. A. 13h 25.4m, Dec. + 0° 35′. 7.8 and 8.9 mag.

1831.78	1.″544	20.°97	7 days.

The angle in 1825 was 10°, and in 1835, 25.°6. Hence a change of the angle is rendered certain.

1424. τ Leonis = H. 1. 28. R. A. 10h 10.4m, Dec. + 20° 44′.

1828.14	2.″458	102.°03	6 days.
1831.34	2. 484	103. 26	5 "
1832.75	2. 504	103. 46	5 "
1835.16	2. 562	104. 94	5 "

1536. ι Leonis. R. A. 11h 14.8m, Dec. + 11° 29′, 3.9 and 7.1st mag.

1832.01	2.″193	92.°38	12 days.

The angle is regularly diminishing, so that for the epoch t it may be denoted by

$$92°38 - 0.°834\ (t - 1832.01)$$

1909. 44 Bootis = H. 1.15. R. A. 14h 58.0m, Dec. + 48° 22′, 5.2 and 6.1 mag.

The observations of this pair shew a remarkable increase in distance between 1826 and 1835, while the angle has undergone but little change. The comparison of the early observations with the more recent, leads to a very interesting result.

1781.62	less than 2.″	60.°1	
1802.25		62. 9	
1819.43	1.″5	228. 0	
1821.33		229. 1	
1826.79	2. 230	231. 0	1 day.
1829.20	2. 555	233. 65	2 "
1832.95	2. 963	234. 47	3 "
1835.51	3. 173	235. 23	6 "

These data indicate that the plane of the orbit of the companion passes nearly through the solar system. As the distance has been continually increasing since 1819, and as the elder Herschel saw the companion on the other side of the principal, it appears that a central occultation must have taken place between 1802 and 1819. Probably the companion was between 1781 and 1802 at its greatest elongation on the one side. It is now approaching its greatest elongation on the other side.

2909. ζ Aquarii = H. 11. 7. R. A. 22h 19.8m, Dec. — 0° 55′

1825.73	3.″600	359.°80	2 days.
1832.81	3. 458	355. 29	3 "
1835.66	3. 356	353. 20	5 "

The well known increase of the angle of position of these stars, appears now to be accompanied with a variation of their distance.

2120. Herculis 210. R. A. 16h 57.6m, Dec. + 28° 20′, 6.4 and 9.2 mag.

The mean of 11 measures from 1829 to 1835 gives

1833.25	3.″445	3.°08

The distance and angle are rapidly diminishing.

1110. Castor = H. 11.1. α = 7h 23.5m Dec. + 32° 15′.

1826-22	4.″404	262.°54	5 days.
1827.28	4. 417	262. 32	4 "
1828.89	4. 358	261. 10	5 "
1831.31	4. 464	259. 58	5 "
1832.86	4. 525	257. 72	4 "
1835.33	4. 734	255. 48	5 "
*1836.26	4. 647	255. 62	

It is remarkable that Struve's measures shew the distance to be increasing, while *Herschel II*, from his researches concerning the orbit of Castor, has arrived at the opposite conclusion, viz: that these two stars should still approach each other, till in 1856 they are to be only 0.″68 apart. The observation of Dr. Mädler confirms the remark of Struve. The angular motion of the companion is so slow, and the change of distance so small, that perhaps half a century of nice observations will be required to determine the elements of its orbit.

1263. Anonyma. R. A. 8h 33.7m, Dec. + 42° 19′, 7.6 and 8.2 mag.

This pair of stars offer a remarkable change of distance and angle, as appears from the following mean yearly results.

1828.36	4.″86	359.°0	1 day.
1829.36	5. 43	4. 12	2 "
1831.31	7. 08	4. 95	2 "
1832.33	7. 455	7. 27	2 "
1833.29	7. 973	8. 00	3 "
1834.36	8. 933	8. 40	3 "
1835.35	9. 595	9. 29	4 "

1888 ξ Bootis = H. 11. 18. R. A. 14h 43.3m, Dec. + 19° 49′.

1829.46	7.″217	334.°17	4 days.
1832.40	7. 140	331. 10	2 "
1835.43	7. 070	328. 98	5 "

* Mädler's observation.

2272 70 *p* Ophiuchi = H. 11.4. R. A. 17h 56.6m, Dec. + 2° 33′.

Struve's measures give:

1819.64		168.°48	5 days.
1820.77		160. 25	2 "
1821.74		157. 65	5 "
1822.64		153. 87	3 "
1825.57	3.″984	148. 22	14 "
1827.02	4. 375	145. 15	2 "
1828.71	4. 782	140. 22	4 "
1829.59	5. 087	138. 08	6 "
1830.84	5. 310	135. 75	2 "
1831.68	5. 410	134. 70	5 "
1832.75	5. 553	133. 97	3 "
1834.47	5. 852	131. 15	4 "
1835.60	6. 108	130. 76	5 "

60. *η* Cassiopœia = H. 111. 3. R. A. 0h 38.5m, Dec. + 56° 53′.

1827.21	10.″25	85.°6	1 day.
1832.05	9. 780	87. 60	5 "
1835.26	9. 520	91. 23	3 "

These observations shew a diminution of the distance as well as an increase in the angle of position.

1516. Anonyma. R. A. 11h 3.7m, Dec. + 74° 25′, 7.0 and 7.5 mag.

This pair of stars is worthy of special observation.—Struve's measures give:

1831.54	9.″930	298.°70	2 days.
1832.84	9. 560	299. 37	2 "
1833.46	9. 250	299. 75	2 "
1834.43	8. 945	300. 97	2 "
1835.56	8. 425	301. 67	4 "

These show a diminution of distance and an increase in the angle of position. Besides South's and Struve's measures, an observation in the Histoire Celeste of Lalande, of the difference of R. A. and Dec., confirms this remark. The old observations give:

1790.21	29.″26 $\mp$ 6″	298.°58 $\mp$ 15°
1823.92	14. 22	
1824.28	12. 479	296. 27

From these measures there follows the remarkable result, that these two stars, now distant only 8″, were forty-five years ago 30″ asunder.

2708. Anonyma. R. A. 20h 32.0m, Dec. + 38° 1′, 7.0 and 8.7 mag.

Struve's observations give, from 1828 to 1835,

1832.63	11.″252	351.°72

The distance and angle are both varying, they may be thus expressed:

$$11.''252 + 0.''206\,(t - 1832.63)$$
$$351.^\circ72 \;- 0.\,823\,(t - 1832.63)$$

2758. 61 Cygni = H. IV. 18. R. A. 20h 59.0m, Dec. + 37° 54′.

These stars shew an increase in distance and angle of position.

1821.62	15.″02	84.°38	
1828.72	15. 31	89. 4	1 day.
1831.70	15. 632	91. 16	4 "
1832.77	15. 790	92. 35	1 "
1835.65	15. 967	93. 83	6 "

Examination of Col. Reid's work on the Law of Storms; by James P. Espy.

My friend, President A. D. Bache, on his return from Europe, put into my hands a highly interesting work by Lt. Col. W. Reid, C. B., of the Royal Engineers, being "An attempt to develope the law of storms, by means of facts, arranged according to place and time, and hence to point out a cause for the variable winds, with a view to practical use in navigation."

This work is illustrated by charts showing the direction in which the various storms investigated moved along the surface of the sea, and showing the locality of the ships whose logs are given in the body of the work.

This work furnishes many additional proofs of that beautiful generalization first hinted at by Franklin, afterwards by Dr. Mitchell, of New York, and lately established in the most satisfactory manner, according to the true principle of inductive philosophy, by Wm. Redfield, of New York: namely, "*Great storms which originate in the windward Islands of the West Indies; progress from the place of commencement in a curve towards the N. W., till on reaching the lat. of 30° N., when they are moving nearly towards the N., their motion after this is towards the N. E. as far as traced.**

From all the facts collected by Mr. Redfield, by the joint Committee of the American Philosophical Society and the Franklin Institute, and by Col. Reid, it would seem that these storms constantly become wider and wider, from their place of commencement, and perhaps elongated in their N. E. and S. W. diameter after they reach a lat. as high as 40° or 45°.

Col. Reid agrees with Col. Capper and Mr. Redfield, that these storms are in the form of great whirlwinds; and Sir John Herschel who is of the same opinion, "does not see how Mr. Espy's theory, though he considers it ingenious, is tenable against the indications of the barometer, for unquestionably if a large body of air, he says, were to set on every side inwards towards a central ascending column, the necessary effect would be an increase of weight of the entire barometric column."

Now this objection is so obvious, that any theory, which has no answer for it, or which does not contain an answer to it in itself, does not deserve the name of ingenious; and it arises from so imperfect or inaccurate a view of the doctrine which I teach, that I am sure as soon as Sir John shall see my papers on the subject, he will see and confess that the objection has already been fully answered. If I am right in this matter, Sir John owes it not merely to me, but to the cause of science, on a point which he acknowledges to be of immense importance, to come out and correct his mistake; for such is the weight of his name, that many will not think it worth while to examine a system which has been condemned by Sir John Herschel.

As to Col. Reid, his whole book is a proof that he is much fonder of truth than of theory. He will therefore do me justice. I was highly delighted

* Perhaps they sometimes turn E. or even S. E.

when this book came into my hands; for I saw immediately that it contained a great many facts and simultaneous observations, which would enable me at once to put my theory to a very severe test.

On reading the logs of the several ships, I kept the map of the particular storm open before me, and, drew my pencil across the point where the ship was, drawing an arrow so as to exhibit to the eye which way the wind was blowing at that time in that locality.

When several logs were read, and arrows made in every locality—I was not a little pleased to see, in all the storms, decided proofs of an inward motion of the air, if not exactly to one common centre, quite as nearly so as any one had a right to expect; because oblique forces are known to exist, which must vary the direction of the wind. I shall now give a few examples of that period of the several storms, in which I find the most simultaneous observations.

Savannah la Mar Hurricane of 3d *Oct.*, 1780.

About 1 P. M., at Savanna la Mar, on the 3d, the gale began from the S. E. and continued with increasing violence until four in the afternoon, when it veered to the S., and became a perfect tempest, which lasted in force till about eight; it then abated. The sea during the last period exhibited a most awful scene; the waves swelled to an amazing height, rushed with an impetuosity not to be described on the land, and in a few minutes determined the fate of all the houses in the bay.

Log of the Badger, at Lucia Bay, Jamaica.

P. M., of 2d, moderate wind, N. E., at 9 hard rain, and continued raining all night with squally weather; at 10 A. M., of the 3d, tripped our anchor, let her drive within the point of the Fort till it bore N. by E., distant three quarters of a mile, and the eastermost N. E. by N., distance one mile and a half; heavy squalls with hard rain; down top-gallant sails.—1 P. M., wind N. E. let go the sheet anchor in five and a half fathoms; muddy; veered the cable, and brought both anchors ahead; continued very heavy gales with hard rain. At 4, let go another anchor. At 3.30 both sheet and bower anchors came home; veered away the clink round the mast, when the best cable parted and then immediately the sheet cable parted likewise. At 5, she was driving on shore very fast, when a gust of wind laid her down, with the comings of the hatchway in the water. By consent of the captain and officers, cut away the weather halyard to the main shrowds, when the main mast went about twenty feet above deck; she immediately righted, and drove broad-side on shore, abreast of the town; the sea making a free passage over us, when our boat went to pieces along side. At 5.30 cut the bower cable to let her swing end on. About 6 it fell calm for half an hour, when the wind shifted round to S. W., blowing a hurricane with strong flashes of lightning. At 10, it became quite moderate.

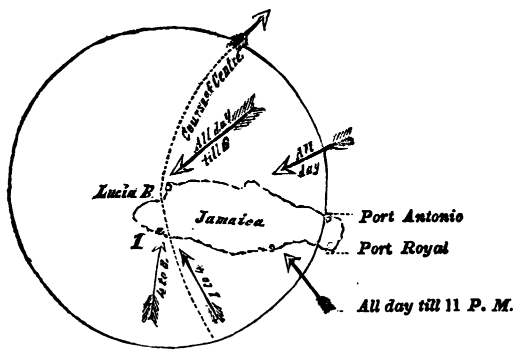
The Phœnix, off Port Antonio.

When the Phœnix was in company with the Barbadoes, off Port Antonio, the wind began to blow, with a stormy appearance, to the eastward, about 11 at night of the 2d of October, and the Phœnix then close reefed her top-sails. At 8 on the morning of the 3d, the wind was E. N. E. with occasional heavy squalls; and Sir Hyde Parker, who commanded the Phœnix, remarked that the weather had the same appearance as he had observed in

the commencement of a hurricane in the East Indies. He then ordered the top-sails to be taken in, and wore the ship in order to keep mid channel between Jamaica and Cuba. At 2 P. M., the Phœnix lay-to, with a storm mizen stay-sail, and her head to the northward. When night set in, the storm increased with great violence. At midnight the wind was southeast, and the ship drawing upon Cuba, Sir Hyde Parker determined to wear her, but no canvass could withstand the wind at this time, and she was wore by sending 200 of the crew into the fore-rigging. When about to cut away the masts, the ship took the ground on the coast of Cuba; and it was 5 o'clock in the morning of the 4th of October.

Journal of Princess Royal, in Port Royal Harbour.

On 2d October, the wind was S. E. and E. S. E., A. M, and the people employed in caulking the ship's bottom. P. M. the wind was S. E. by E., and squally weather, with rain; people employed as before; violent squalls with heavy rain in the night, wind from the southeastward. On the 3d, A. M., the wind E. S. E. to S. E. and gale increasing with much rain; people employed in securing the ship; by the violence of the wind in the night the mizen-topsail, fore-top-gallantsail, and main-top-gallantsail, that were covering tents in the yard, and had been condemned by survey on the 30th of September, were entirely blown to pieces. P. M. wind S. S. E., and excessive hard squalls with thunder, lightning and rain; people employed as before. At midnight more moderate and light rain.



1. *Savannah la Mar; destroyed Oct.* 3, 1780.

These are all the data we have concerning this storm, yet it will be seen though we have no observations on the western half of this storm that the centre of it passed over Lucia bay, from 6 to 6½ P. M., and at that very time and for some time before and after, the wind on the other side of the island at Savannah la Mar, was blowing a hurricane from the south, exactly towards Luçia bay. The wind also at Port Royal in the southeast corner of the island was blowing nearly to the same point, and from the log of the Phœnix some place between the east end of Jamaica and Cuba the wind was violent E. N. E., almost exactly towards Lucia bay. The reader will observe that when the wind changed at Lucia bay, and with the Phœnix, all the four arrows, if drawn on the chart, would point to a spot near where the Phœnix was wrecked, not many hours afterwards, on Cuba.

Great Barbadoes Hurricane, of October 11, 1780.

At Carlisle bay, on the west side of Barbadoes, it was remarkably calm on

the evening of the 9th October, but the sky was remarkably red and fiery. During the night much rain fell. On the morning of the 10th, much rain and wind from the N. W. By 10, it increased very much. By 4, P. M., the Albermarle frigate parted and went to sea, as did all the other vessels, about twenty-five in number. By 10 P. M., the wind forced itself a passage through the house from the N. N. W., and the tempest increased every minute.

At St. Lucia,

All the Barracks and other buildings in the island were blown down.

At St. Vincent,

Every building was blown down.

At the town of St. Pierre, in Martinique,

Every house was blown down, and more than 1000 people perished.

At Fort Royal,

1400 houses, besides the churches and public buildings, were blown down.

At St. Eustatia,

On the morning of 10th, at 11 o'clock, the sky on a sudden blackened all round; it looked as dismal as night, attended with the most violent rains, thunder, and lightning ever known before. In the afternoon the gale increased. In the night every house to the northward and southward, was blown down or washed away into the sea, a few only escaping. The houses on the east and west were not so much hurt, till the P. M. of the 11th, when the wind, on a sudden, shifted to the eastward; and at night it blew with redoubled fury, and swept away every house.

At Barbadoes,

It began to blow on the 9th, but on the evening of the 10th the wind rose to such a degree of violence, as clearly to amount to what is called a hurricane. At 8 P. M. it began to make impression on all the houses by tearing off the roofs, and overthrowing some of the walls. It was thought to be at its greatest height about midnight, and did not abate considerably until 8 next morning.

Log of the ship Albermarle, lying in Carlisle Bay, on the west side of Barbadoes.

On the afternoon of the 9th, wind E. moderate and hazy. Morning of 10th, E. N. E., blowing very hard, At 1 P. M., N. E. by N. strong gales with hard rain at times. The gale increasing, the officers decided to go to sea, which was done at 2 P. M., wind N. N. E. At 30 minutes past midnight, still blowing a hurricane, with rain, and wind shifting to westward. At 5 in the morning, of 11th, the wind shifted round to the southward, still blowing very hard, with constant rain. At noon, still blowing a hurricane, with hard rain. P. M. still blowing a hurricane, with wind S. E. by S., with constant heavy rain. At 4 saw the northwest end of Barbadoes bearing N. E. by N. distance 4 or 5 miles. At 4.30, wind shifted round to S.E. and heavy gales of wind with constant rain. At 5 A. M., of 12th, more moderate but fresh gales continued S. E. in P. M.

Log of the Vengeance.

Moored in Careenage on west side of St. Lucia. Dark cloudy weather

on the afternoon of the 9th. The Blanche and Alcmene sailed at 6 A. M. of 10th. On the afternoon of 10th, strong squalls; at 7.30 P. M., very strong squalls, variable. At 9 P. M. the Ajax parted her cables and went out to sea. At 11 the gale increased very much. At 12 the Egmont slipped and went out to sea—wind variable all this time. At 4.30, A. M., of 11th, the Montagu slipped and ran out to sea. At 8.30, wind N. E., and the Amazon slipped and ran out to sea. Several transports drove on shore and dismasted in the harbour. At noon violent squalls and N. E. At 12.15, parted the small bower and brought up with the stream and sheet anchors. . . . . Cut away the long boat, cutter, and schooner tender, which were immediately dashed to pieces; the hurricane still increasing and the ship striking at times. At 8, wind N. E. by E., and veering round to eastward. At 9, lightning between the squalls, still blowing excessively hard, with rain. At 10, less wind with more rain and lightning. At 12, the hurricane abated with rain. At 4 on morning of 12th strong gales and squally, with heavy rain. At 11 A. M. wind E. S. E. In the afternoon, wind E. S. E., moderate, with rain. At 8, thunder and lightning and rain.

Log of the Alcmene.

At 1 P. M., of 10th, wind N. N. E.; fresh breeze and squally. At 2 P. M. got under way from the Careenage in St. Lucia, in company with the Blanche. At 5 P. M., N.½E., Martinique E.¾N., 6 leagues. At 8, N. by E. At 10 N. N. E. At 3 in the morning of 11th, N. by E., hard gales and rain. At 7 N. N. E. At 10, very hard gales and rain; great sea. At 1 P. M., hard gales and thick weather with rain, wind variable. At 4, lost sight of the Blanche bearing S. S. E. half a mile. From 5 till 9, wind N. W. and gale increasing. At 12, gale still increasing, and wind S. E., from 10. At 3 A. M., of 12th, wind S. W. At 7, wind S. by W. At 10, gale abated, saw a ship ahead, supposed to be the Blanche. At 1 P. M., wind S. S. E., fresh gales and squally. At 3 P. M., wind S. E. At 10, saw Martinique E. by N., 5 leagues.

Log of the Egmont.

At 10 A. M. of the 10th, squally and wind variable. At 12, northwardly squally and hard rain, sailed from the Careenage in St. Lucia in company with the Blanche and Alcmene. At 1 P. M., wind N. by N. fresh gales and squally, with rain. At 6 P. M., E. N. E. At 7, came on a heavy squall of wind with rain, which parted the small bower cable at twenty fathoms from the anchor. At 9, wind N. At 10, N. by W. At 11.30, cut away the best bower at a whole cable and went to sea. Midnight N. E. by N., split the main topmast-stay sail. At 4 A. M. of 11th, strong gales with hard squalls of rain. At 7 carried away the main-staysail. At 8 A. M., wind N. by W. At noon, St. Lucia, N. 19° E., distance thirteen leagues. At 1 P. M. of 11th, wind N. E., very strong gales with hard squalls and rain. From 10 at night till 8 next morning while the storm was most violent the wind was from all quarters. It then became S. S. E and S. E., and so continued till the end of the storm. At noon of 12th, St. Lucia, N. E. by E.¾E. distance eleven leagues.

Log of the Montagu, lying off the entrance of the Careenage, St Lucia.

On P. M. of 10th, wind N., strong gales with heavy squalls of rain and a heavy swell from N. W. At midnight parted or slipped ship Ajax. At 3 A. M. of 11th, slipped and put to sea the ship Egmont. At 5.30, in preparing to slip and put to sea, we parted our stream and small bower cables; stood

out W. N. W. till 8 A. M. South end of St. Lucia then bore S. S. E., nine or ten leagues, wind N. N. E., brought her to with her head to the northward, up N. W., off W. by N., very strong gales. At 1 P. M., wind N. N. E., a very heavy storm, with rain. At 3.30, in cutting the main and fore-topmast, the mainmast, fore and mizenmast, all went over the side; a heavy storm of rain. At 4.15, the bowspit went by the outer gammon, and carried away the greater part of the head. At 6 and 8, wind N. by W., weather the same, and very high sea. At 5 A. M., wind W. S. W. and more moderate. At 9 A.M. saw the Sugar Loaves of St. Lucia bearing E.½N., distance four leagues; the Island of St. Vincent then E. S. E., distance six leagues. At noon moderate breezes and high sea, cloudy with rain—Sugar Loaves E., distance two leagues.

Log of the Amazon, in the Careenage.

On the afternoon of 10th, fresh breezes with hard squalls. At 6 P. M. the Egmont parted, and brought up again under our stern. At 9, the Ajax put to sea. At 11, the Egmont cut and put to sea; excessive hard gales with rain. At 4 A. M., wind northeasterly, the Montagu parted and put to sea. At 7.30, finding the gale increase, slipped the small bower and stream cables, and cut the best and put to sea. Noon, blowing a hurricane with a heavy sea. At 2 P. M., blowing a perfect hurricane N. E. At 7.30, by the violence of the hurricane the ship overset, and lay in that situation 7 or 8 minutes. At 8, the wind N. W., and ship quite righted with 10 feet water in the hold. At 2 A, M. of 12th, pumps choaked with seven feet water in the hold. At 4 A. M., found the wind abate. At noon, wind N. N. W., gale much abated. In P. M., wind E. by S., first part hard gales with rain. At 5, wind had been quite round the compass in the last twenty-four hours. On the afternoon of 13th, wind still E. by S. with fresh gales and hazy weather with rain. At 6, the body of Martinique E. by S. distance eight or ten leagues.

Log of the Endymion, N. N. E. of Martinico.

On the afternoon of the 10th, wind N. E. strong gales and hard squalls. At 4, saw the N. E. end of Martinico S. W. by S., distance seven leagues. At midnight, strong gales continue. At 8 A. M. of 11th, wind E. N. E. heavy gales and strong squalls. At noon blows strong and violent squalls, N. E. end of Martinico W. S. W., distance four leagues. At 1 P. M., wind E. N. E., strong gales and hard squalls. At 3 A. M. of 12th, just weathered the island of Caraval, the N. E. end of Martinico. At 5, the wind E. At 7, wind E. by N., hove-to under a mizen topsail. At noon, wind E. S. E., continuing a heavy gale and violent squalls.—N., end of Martinico, distance fifteen leagues.

To these particulars extracted from Col. Reid, I am enabled to add the following from the Pennsylvania Gazette of 1780.

Pennsylvania Gazette of December 13, 1780.

At Bridgetown, Barbadoes, (which is on the southwest side) the wind began to blow very fresh soon after daybreak of Tuesday the 10th of October, and increased till 4 o'clock next morning. The wind during the greater part of the hurricane, blew from the N. E. quarter, and never shifted to the southward further than S. E.

From the same paper of December 6.

On the 10th at St. Pierre, on the west side of Martinique, a sudden gale sprung up from N. E., and though the gale increased and continued without

intermission, the shipping kept their stations as the wind blew off the land till the 11th. On the night of the 11th, the wind shifted to the southward, and after continuing there two or three hours, shifted to the S. W. and blew right on shore. Between 2 and 3 o'clock of the morning of the 12th, the sea was thrown into the most violent agitation, and raged with incredible fury and destroyed many houses and stores on the bay.

At St. Christophers the wind abated on Saturday the 14th, but about 8 o'clock it changed to the southward, and drove the Minerva on shore. At Bassetere, St. Christophers, it began a gale about midnight of Wednesday the 11th and increased all next day.

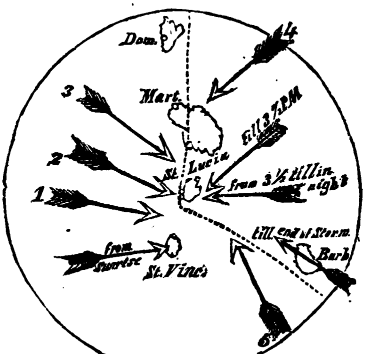
Same Paper of December 20.

At St. Vincents the wind came round to N. W. on Tuesday night the 10th, and blew very fresh all night from that quarter. At sunrise it came rather more to the westward, and the gale increased, and from 12 till 4 P. M. there never was such a scene. The wind began to abate at 5 P. M.

Great Barbadoes Hurricane, Oct 11th, 1780.

1. *Montagu from* 6 *to* 8 *P. M.*
2. *Amazon at* 2 *P. M.*
3. *Alcmene from* 5 *till* 9 *P. M.*

4. *Endymion from P. M. of* 10*th to* 12*th.*
5. *Albemarle from* 4½ *P. M. till next day.*



The dotted line is the course which the centre of the storm moved in.

By casting the eye on the map which is intended to represent the locality of the storm at 6 P. M. of the 11th, it will be seen that all the arrows fairly within the action of the storm are directed inwards to a central space of no great magnitude.

This action lasted for several hours of the evening of the 11th; and did not vary until the centre of the storm, towards midnight, passed the Alcmene, the Egmont, and the Montagu, in its motion towards the N. W. And it is worthy of particular remark that as the storm passed on, the wind to all these vessels changed round to the S. E., as it had already done at Barbadoes, and to the Albamarle near Barbadoes.

Now as the centre of the storm passed over or very near all these places, it will readily be perceived that the manner in which the wind changed, accords exactly with the idea, that the wind blows inwards towards the centre of these storms; and not at all with the notion that it blows in the form of a whirlwind. When I take up some of the other storms I shall notice this fact more particularly. I shall only mention here that Mr. Edwards says, in the third volume of his History of Jamaica, that "*all hurricanes begin from the N., veer back to the W. N. W., W., and S. S. W., and when got*

round to S. E. the foul weather breaks up." And Col. Capper in speaking of a great hurricane which occurred on the coast of Coromandel, on the 29th October, 1768, page 60, says "the wind began from the N. W. *as is usual at the commencement of these hurricanes.*"

I shall not give charts of this storm for the subsequent days; but if any one who has Col. Reid's book will read the logs of the Endymion, and the Convert, and the Egmont, and the Diamond, for the 15th and 16th, he will find, if he draws arrows on the charts representing the direction of the wind on these several days, a remarkable convergence towards the centre of the storm. And if he extends his observations to the 17th and 18th, he may include the Grafton with the ships mentioned before. Now as these ships were several hundred miles apart, the evidence is conclusive, that on all these days the wind did blow inwards to the centre of the storm.

But there is one remarkable feature in this storm which must not be passed over in silence. Its centre in its motion turned out of its regular course and passed over Martinique a little after midnight of the 11th. At this time the Endymion, on the N.N.E. of that island had the wind violent from the E.N.E.; and at St. Pierre on the south-west side of the same island the wind was S. W. And the Alcmene some fifteen or twenty miles to the S. S. W. of the island, had the wind S. W. to S. S. W. about the same time for several hours. The intelligent reader will perceive how the wind from the N. E. striking on the eastern side of this island whose mountains are of considerable height, would glance upwards, and thus form a cloud over the island, and thus cause the centre of the storm to locate itself for a time over that island.

Antigua Hurricane of 2 *Aug.* 1837, *at Antigua.*

On the 2nd of August, between 2 and 3 A. M. we had a smart gale from north, which crept gradually round by the north-west, west, and south-west, until it died away in the south-east.

One barometer at Antigua, in the gale of the 2d, only sunk .43, another sunk .63.

At Nevis,

On the morning of August 2d, between 3 and 4, the wind being north, a shower of rain fell. At half-past 6, A. M. the wind began to rise until 8, it then shifted to the N. N. W. and gradually increased in gusts until 10, during which time much rain fell. The wind then veered to the westward, and next to due south, then back to south west, and last backed to south again, from whence it blew steadily and with violence until 2, P. M., when it abated.

At St. Kitts,

Early on Wednesday morning, the 2d of August, the wind blew strong from the north, and indicated the forthcoming storm. At about 8, A. M. it veered to N. W. and shortly afterwards to west, during which time it blew a perfect gale, throwing a tremendous sea into the harbour, and threatening the destruction of every vessel.

At St. Bartholomew,

The storm commenced at north-east, and continued to increase in violence until 2 P. M.

At St. Martin,

A gale commenced about 9 A. M. and raged with great violence from 11 A. M. to 2 P. M., veering from E. N. E. to N. W.

At Santa Cruz,

On Monday the 31st July, 1837, the weather was moderate; several ships

sailed on Tuesday the 1st of August; in the evening the wind was north-east and the weather moderate. On Wednesday the 2d, the wind during the night had shifted to the north; the weather looked squally, cloudy and suspicious, and continued so during the afternoon; the wind shifted gradually to the N. N. W. At 1 P. M. the falling of the barometer, the appearance of the weather, and the increasing wind, left us no doubt of the approaching storm, and it came on from the north-west between 3 and 4 P. M. The mercury continued falling, and the gale increasing, until half past 6 P. M. when the wind became westerly. At 7 P. M. the mercury began slowly to ascend, and yet the storm increased in violence. At 8 P. M. it was blowing a hurricane from the west-south-west to the south-west, coming in furious gusts until 10 P. M., when a certain decrease in their violence had taken place, which abatement continued until Thursday morning the 3d of August, when it blew a fresh gale from the south.

Log of the Water-Witch.

Arrived off St. Thomas on the 2d August; morning squally and the Water-Witch was off St. John's, and standing for St. Thomas's, the wind north and north-north-west. Noon, shipping in the harbour visible; at 1 P. M. squalls violent; at 3 P. M. we had beat up within half a mile of the forts, when we could proceed no further from the violence of the squalls, and anchored in ten fathoms water; sent down top-gallant-yards, &c.; did not suspect a hurricane. At 5 P. M., squalls ceased, and began a heavy gale of wind, at that time off the land. At 7 P. M. a hurricane beyond all description, dreadful; the windlass capsized, and I could not slip my cables, ship driving until I was in twenty fathoms water; a calm then succeeded for about ten minutes, and then in the most tremendous unearthly screech I ever heard, it recommenced from the south and south-west. I now considered it all over with us, for the wind was directly on shore, and the sea rose and ran mountain high. At 2 A. M. the gale abated somewhat, and the barometer rose an inch; at day-light, out of forty vessels, the Water Witch and one other were the only two not sunk, ashore, or capsized.

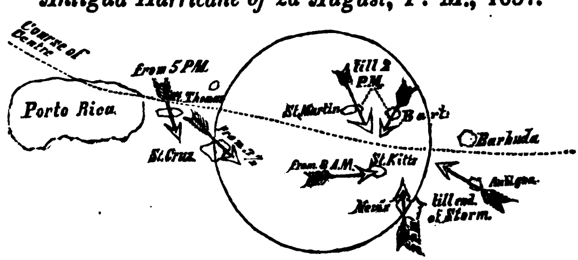
Porto Rico.

At 4 P. M. on the 2d of August, 1837, in consequence of having observed the barometer falling, I ordered all the vessels in the harbour, to prepare for stormy weather, although the fall of the barometer was not great.

At 8 P.M.	the barometer	was at	29.6	At 12	midnight,	barometer at	28.00
9	"	"	29.5	1½	A. M.	"	29.17
10	"	"	29.4	4	"	"	29.50
11	"	"	29.3				

At 9 P. M. the wind was strong N. N. E. At 11 veering to east, and blowing in an alarming and furious degree till midnight, when every vessel was sunk or ashore. At 4, the wind fell, and then veered to the south.

Antigua Hurricane of 2d August, P. M., 1837.



It appears from these accounts that the wind, from some time before 2 P. M. till 2, was blowing inwards to a central space between Antigua and St. Martins, from four different localities, Antigua, Nevis, St. Martins and St. Bartholomew.

It is worthy also of particular remark that the barometer fell at Porto Rico to 28 inches, and rose to 29.17 in an hour and a half. As this storm moved about 10 miles in an hour, it would appear that the barometer was lower in the middle of the storm by 1.17 inches than it was at the distance of fifteen miles, and if so, the velocity of the up-moving column in the middle of the storm may be calculated according to the laws of spouting fluids, and will be found to be upwards of 260 feet per second. From this the quantity of vapour condensed in a second may be calculated.

Barbadoes Hurricane of 26th July, 1837. *At Barbadoes,*

At 2 o'clock A. M. of 26th July, light showers of rain, wind shifting from south to north-west, the sky dark and gloomy, with flashes of lightning in the south-east and south-west. At 4, calm with a heavy swell rolling into the bay; lightning and thunder, sky assuming a black appearance, with a red glare at the verge of the horizon; every flash of lightning with an unusual whizzing noise, like that of a red hot iron plunged in water; at 6, the barometer fell rapidly, the sympiesometer much agitated and unsettled, and fell at length to 28.45. At 7.30 the hurricane burst on us in all its dreadful fury; at 8 it shifted from east-south-east to south, and blew for half an hour, so that we could hardly stand on deck—the wind shifting to south-west, at 9 the barometer began to rise, and to our great joy we saw a change in the sky for the better. As the haze cleared away, we counted twenty-one sail driven on shore.

At St. Vincent.

Our paper from St. Vincent informs us that the gale of the 26th July was severely felt there; the wind being from the west and south with a heavy swell of the sea.

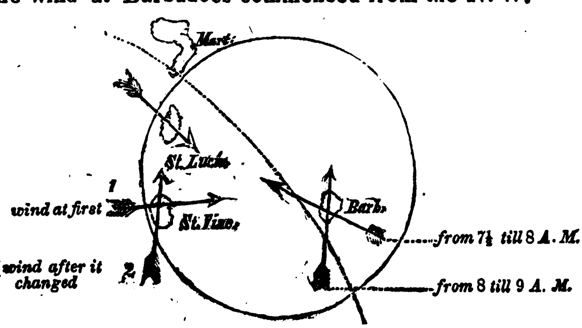
At St. Lucia.

We have experienced a severe gale from the north-west, which lasted several hours.

At Martinique.

Martinique suffered a severe gale on the 26th July, from the south-east. The tempest raged there at 10 P. M., at which hour all was calm at Barbadoes.

When the storm was raging at Martinique, it was calm at Barbadoes. The wind at Barbadoes commenced from the N. W.



It is evident that the wind in all these four storms, blew inwards from the circumference towards a central space of no great magnitude. I shall at some future time examine the other hurricanes in which simultaneous observations can be found, and I hope to show some strong cases in favour of an inward motion. There is one which I have already examined, which is more striking than any of the four here given; I mean that of the 18th of August, 1837. I have been able to add from the American newspapers some observations on that storm, which will render the phenomena much more striking. These observations are copied here for the sake of those who may have Col. Reid's book, who can then examine the storm for themselves.

The Philadelphia Commercial Herald of 28th of August, says "barque King Philip on the 18th of Aug. lat. 31° 12′, long. 78° 16′, gale from N.N.E. to W.N.W.

The same paper of 29th of Aug., says "brig Oglethorpe, on the 18th of Aug. lat. 32° 29′, long. 78° 55′ had a violent gale from N.W."

If the reader will now turn to Col. Reid's account of this storm and mark with his pencil on the chart the direction of the wind on the 18th of Aug., 1837, he will find that the arrows of the following places all point inwards, towards a space where the West Indian and the Duke of Manchester were labouring in the centre of the storm at that time. The Oglethorpe, the Ida, the Rawlins, the Cicero, the Delaware, the Mary, the Westbrook, the Sophia, and at Wilmington. He will moreover observe that the localities are all round the centre, several hundred miles apart, as favourably situated as could be desired for ascertaining the direction of the wind in this storm at a particular time.

The reader will find but two arrows which do not point towards this central space; the Penelope, which seems to indicate a rotation of the wind from right to left; and the Winchester, which seems to indicate a rotation from left to right. These anomalies I hope to explain satisfactorily, and in such a manner as to add a strong link to the chain of argument in favour of an inward motion of the air towards the centre of the storm, if indeed any other evidence, than that of the fact itself, is necessary.

Now if the wind did blow inwards in all these storms, all the phenomena can be accounted for, from the single fact which I have demonstrated from experiment, as indicated in a publication of mine in the Saturday Courier of March 18, 1837.

For as the air must have moved upwards over a central space of undefined magnitude in all these storms, I have demonstrated by experiment that the cold due to diminished pressure, would condense one half its vapour when it reached six thousand yards, a quantity sufficient in ordinary states of the dew-point to produce three inches of rain in that climate. The condensation of this vapour, as I have demonstrated by experiment, would give out into the air in contact with the condensing vapour, caloric of elasticity sufficient to expand that air between five and six thousand cubic feet for every cubic foot of water generated, after making allowance for the diminished volume due to the condensation of the vapour itself into water.

This will cause the barometer to fall more than two inches in the centre of the storm, and to rise all round on the outside of the storm especially on that side towards which the top of the cloud is pressed by the upper current of the atmosphere into which the cloud penetrates—and that will be the direction in which the storm will move along the surface of the earth; all which I have elsewhere shown.

As the cloud moves along, being pushed by the upper current, the air

under the cloud will, on account of the specific levity of the cloud, ascend, and thus the action will be continued. Moreover I have demonstrated from experiment that if the barometer falls two inches under the base of one of these clouds, the air will not have to ascend so high, by eight hundred yards, before it begins, by the cold of diminished pressure, to form cloud—and this in many cases, will bring the cloud down on the surface of the sea; or in other words the vapour of the air in the outside of the storm will begin to condense, as soon as it comes under the base of the cloud, from the cold produced by diminished pressure there.

It is not a little remarkable that all these storms and others which have been traced in the West Indies, traveled towards the N. W. almost at right angles to the direction of the trade wind in those latitudes; but very nearly, if not exactly, in the direction of an upper current of the air, known to exist there towards the N. W. The direction of the trade wind, will therefore produce an oblique force, which will cause the wind to set in at the beginning of these storms, not exactly towards the centre of them, but towards a point west of that centre, and if this single circumstance should be observed without attending to all the phenomena, it would undoubtedly give rise to a suspicion, that the wind in these storms rotates from right to left. And if to this circumstance be added, that these storms are nearly round in this latitude, and that the air at some moderate distance around them is nearly calm, the investigator will be confirmed in his first impression, and perhaps not even think it worth while to mark on his chart, by arrows, the course of the wind in the simultaneous observations at his command. And if to all this is added his belief, that the air in a cloud is denser and heavier than surrounding air at the same elevation, he will consider that it amounts to absolute demonstration, that there must be a whirl, as that is the only possible means of causing a depression of the barometer under all these circumstances in the middle of the storm. Again, if he believes that the cold air from above, coming down in the centre of the whirlwind, which it would do, mingles with the warm air below, and thus produces condensation of its vapour, he thinks he has got hold of a fact, which enables him to explain many phenomena connected with the storm, though the whirlwind itself remains unexplained, as it always must. But if he will examine this subject a little more minutely, he will find, that if air should descend from a height sufficiently great to double its density at the surface of the earth, its dew-point will be raised only 20°, and its temperature by increased pressure above 80°, and that it will then be extremely dry, even if it had been saturated at the commencement of its descent. In fact, it would then be able to contain about eight times as much vapour as it contained before its descent; for at these low temperatures every increase of temperature of 20° doubles its power of containing vapour, as may be ascertained by looking at a table of dew-points. In fact the doctrine of mingling air in the atmosphere to produce cloud, as taught by Dr. Hutton, will not stand the test of examination, even if a means could be discovered of producing the mixture. For it must be done either by cold air coming down, or warm air going up—now if cold air comes down, it becomes intensely dry, and if warm air goes up, it will condense its vapour by the cold of diminished pressure, and more so the less it mingles with the upper air. Nor is the doctrine that cloud is heavier than surrounding air at the same height tenable, as was shown before.

The question then resolves itself into a matter of fact: and a question of great moment it is acknowledged to be—is there a centripetal or a centrifu-

gal motion of the air in these storms? If the former is true, all the phenomena are explained; if the latter, nothing is explained; not even the whirling motion itself. Let the careful reader decide.

[TO BE CONTINUED.]

Mechanics' Register.

LIST OF AMERICAN PATENTS WHICH ISSUED IN MARCH, 1838.

With Remarks and Exemplifications by the Editor.

74. For improvements in *Apparatus for making Salt;* Charles G. Reynolds, Kanhawa Salina, Virginia, March 3.

The patentee describes the manner of constructing the furnaces and boilers as previously used at the Kanhawa works, and then gives in detail, by reference to the drawings, the arrangements of what he calls "pan pieces," which he employs in lieu of pans; these pan pieces constitute a succession of troughs having a perforation through the partitions by which they are divided, so that when the brine from the settling cistern is let into the upper pan piece, it is filled to the height of the hole in the second, and so on through a succession of such receptacles. The advantages of this arrangement are set forth by the patentee, and a claim made to the special mode of construction described; but without the drawing any attempt at description would claim more space than our readers would wish to have devoted to that purpose.

75. For a *Bituminous Compound to be used as a Cement;* Cyprian Poullalier, city of New York, March 3.

Since the cement from the asphalte of Seyssel has been attracting public attention, various compositions have been proposed to be made the subjects of patents, as a substitute therefor, most of which have been rejected as being substantially the same with known cements, used in some cases for centuries. That now to be described is to be made in the following manner. For a hundred pounds of the cement, take ten pounds of coal tar; ten pounds of the residuum left after making gas from rosin; twenty pounds of pulverized brick; twenty pounds of the clay of which bricks are made; forty pounds of pulverized stone, gravel, or sand, taking care that when wanted for the finer kind of cement, it be finely pulverized. The whole is to be boiled and well stirred in a cauldron for three or four hours; it is then to be poured into moulds and suffered to cool. When used it is to be melted and laid on in the manner of tar.

The patentee sets forth its good qualities, and then claims "the combination of the materials above mentioned, that is to say, of the residue of coal, which is commonly called coal tar; the residue of common rosin after the gas has been extracted by the usual process; pulverized brick; brick clay; and pulverized stone, gravel, or sand; in the above mentioned proportions, and in the above manner, to produce a cement, or in similar proportions to produce the like result."

We are well assured that a patent was granted for the foregoing in consequence only of the claim being limited to the ingredients specially mentioned,

and in the specific proportions. It appears to be one of those cases where the propriety of granting letters patent is a question of doubt, upon which doubt the decision in favour of the grant rests, the courts being open to the enquiry whether there is any essential novelty in the compound; we think not.

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76. For an improved *Trap for Rats and other Animals;* Thomas Hill, city of Alexandria, District of Columbia, March 3.

This trap is arranged with much ingenuity, but whether the wary animals for whose accommodation it is principally intended, will be inclined to examine its interior is a question to be decided by experience. It has several compartments, the first of which has a sliding door, which rises and falls in the manner frequently adopted in traps; within this first compartment the bait is placed upon a hook, by the moving of which the front doors falls; but the same action opens a passage into a second compartment, the floor of which is a movable platform, or draw bridge, by stepping on which the opening into this second compartment is closed whilst the first slide is raised, and the trap reset. A conical opening of pointed wires, or a sloping fall door allows the rat to advance into a third compartment, leaving the former free for new applicants, and to this third, is attached a fourth compartment, or grand saloon, which may be removed at pleasure, with the animals which may have entered it.

The claim is to "the manner in which the operation of self setting is effected."

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77. For improvements in the *Apparatus for Bleaching Linens, Cottons, &c.;* Samuel W. Wright, a citizen of the U. States, now residing in England; March 3.

"My improvements in bleaching or cleansing linens, cottons, or other fibrous substances, and in the machinery or apparatus for effecting the same; consists, firstly, in the peculiar construction of an air tight vessel in which the goods, or fibrous materials, intended to be bleached, are to be packed in close contact. Secondly, in the manner of passing the alkaline solutions through the compact mass of goods, or fibrous materials, by the agency of steam at a high pressure, which has the effect of opening the fibres of the material under operation. Thirdly, in the manner of rinsing or washing out the alkaline or other chemical matter used in the process of bleaching, by means of high pressure steam. Fourthly, in the manner of forcing the solution of chloride of lime and sulphuric acid through the goods in the bleaching vessel by hydraulic and pneumatic pressure; and, fifthly, in the mode of washing, cleansing, or rinsing the chemical matters from the goods after the bleaching operation has been completed; and, sixthly, in the mode or manner of drying the fibrous goods, or other substances, by passing high pressure steam through them, in a compact state, before removing them from the bleaching vessel, or kier."

This announcement of the objects and general mode of procedure, as set forth in the words of the patentee, will afford a perfectly clear idea of the nature of the invention, and of the kind of apparatus employed; after describing which the patentee says, "It is obvious that the machinery, or apparatus, as above described, may be varied in its form and construction. I do not therefore intend to claim as my invention, the application of high pressure steam to be used with the improved combination and arrangement of the

several parts as applicable to bleaching or cleansing linens, cottons, or other fabrics, goods, or other fibrous substances, as before described."

The process, as described, appears to be eminently well adapted to accomplish the intended purpose in a very perfect and economical manner.

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78. For improvements in the *Machine for Cutting and Dressing Stone;* George M. and John A. Alger, South Stafford, Orange county, Vermont, March 3.

Several patents have been obtained for machines for cutting and dressing stone, and we have been looking for the arrival of one or more of them in Washington, to aid in the preparing of the large quantity of stone employed in building the new Treasury and Patent offices, but not one of them has yet found its way here. Two kinds of stone are used in these buildings, the basements being of granite, and the superstructure of a very friable and porous sand stone; and, certainly, if these machines have not sorely disappointed their projectors, they might be applied to the cutting of the latter, if not of the former.

The claims in the present instance are to "the method of regulating the cutters and frame in which they work; together with the combination of the springs and chisels, or cutter stocks, constructed and operating substantially as herein described." We are appprehensive that the great difficulty in stone cutting machines, is in the cutters themselves, and not merely in the manner of arranging them.

Those which have been patented bear a near resemblance to each other, although they differ in the particular construction of certain parts, upon which the claim to invention is dependent.

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79. For an improved apparatus for *Extinguishing Sparks* in locomotive steam Engines; Jonas P. Fairlamb, city of Philadelphia, March 3.

The claim made is to the particular mode of constructing the apparatus as described, into which description it does not appear necessary to enter, as we are informed that the promised results of "preventing sparks, scales, dust, cinders, or ashes, from going out of chimneys, and *increasing the daught of the same,* so as to facilitate the burning of anthracite and other coal in locomotive and other steam engines," have not followed its use; in proof of which it has been abandoned by the patentee, if a judgment may be formed from his having obtained another patent for a spark arrester.

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80. For improvements in the *Double cylinder Suction and Force Pump;* James J. Rice, Salina, Onondaga county, New York, March 10.

There is sufficient novelty in the arrangement of the respective part of this pump to give it a fair title to a patent on that score; in the points of simplicity, however, it is not to be commended, and in another very important point, that of giving to the water the most direct course, it is signally deficient. Without drawings it would be no easy matter to describe it, and we do not think that the labour would be well bestowed. The claim is to "the before described construction of the pump with the additional outer cylinder; the partitions in the spaces between the outer and inner cylinders, and the form and arrangement of the valves in the circular rims between the said cylinders."

81. For a *Rotary Pounder for washing clothes, &c.;* Christopher Aumock, Elbridge, Onondago county, New York, March 10.

This machine is intended for washing clothes, kneading dough, hulling rice, pounding ores, plaster, corn, oil-cake, &c., and for cutting sausage meat. It consists of a tub placed with the centre of its bottom upon a vertical shaft, and made to revolve horizontally, whilst beaters, pounders, or cutters, placed on the ends of levers, and worked up and down like trip hammers, are to operate upon the materials contained in the tub. The claim made is to "the revolving platform, or tub, in combination with pounders operating substantially as above described."

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82. For an improvement in the *Gimlet;* Ezra L. Hommedieau, Chester, Middlesex county, Connecticut, March 10.

This is said to be an improvement upon Orval Percival's patent gimlet; this gimlet had the pod hollowed down to the point, the screw being formed on the back only; the directions for the improvement are as follows. "After the pod of the gimlet is made and the screw is cut on the back of it, on the left of the centre, at the point of the screw, take out a semicircular piece the depth of one screw, or more, which makes a sharp point, and causes the screw to enter readily, and hold on while it is in the wood. This I claim to be my invention, and of great importance as an improvement on said Percival's gimlet."

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83. For improvements in the mode of *Constructing Locomotive Steam Engines;* Zadoch H. Mann, and Levi B. Thyng, Lowell, Middlesex county, Massachusetts, March 10.

"The nature of our improvements and inventions consists in these particulars. 1st, We construct a fire box with cylinders immersed in water, to prevent them from being fused or consumed by the intense heat of anthracite coal. 2d, We conduct the water from the forcing pumps to a water cylinder, or tube, in the chimney, then take the water from the top of this cylinder, and carry it by small pipes down through the smoke flue, and throw it into the boiler at the forward end. The action of the heat within the flue will make the water hot, if not boiling, before it enters the boiler. 3d, We place the dome within the chimney, and thereby protect it from the external atmosphere."

The claim is in the following words. "What we claim as our invention and improvements are, 1st, The construction of the fire box with separate cylinders immersed in water in the manner described, for burning anthracite or other coal in locomotive engines. 2d, The method of carrying water into the cylinder within the chimney, and conducting it down from the top of the cylinder in contact with the flue, and thereby heating the water to boiling temperature, or nearly so, before it enters the boiler. 3d, The construction of the dome within the chimney, to protect it from the external atmosphere, the whole combined and arranged substantially in the manner herein set forth. 4th, We claim the manner of turning the exhaust steam into the tender, for the purposes set forth."

The lower part of the fire box is made water tight, and within this are placed a number of cylinders, having grates at their lower ends, and being open at top, but so enclosed that the spaces between these cylinders shall be surrounded with water, and shall constitute a part of the boilers.

The boiler is of the ordinary kind, consisting of a horizontal cylinder furnished with draft tubes; on the top of the boiler is constructed the apparatus for heating and conveying the water, &c., which are figured and described. The patentees believe that such will be the saving of heat by this apparatus that only a part of the exhaust steam will be required for increasing the draft in the chimney, and they have therefore devised a mode of carrying it, in any proportion which may be found best, to heat the water in the tender, which apparatus is described and claimed.

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84. For an improvement in *Locks for Guns;* Philo W. Hoyt, Danbury, Fairfield county, Connecticut, March 10.

"The principal improvement in the lock consists in the manner in which I employ a spiral, or helical, spring, as a main-spring, and combine it with the other parts of the lock." This spring is wound upon an arbor, or shaft, which extends through the main plate, and carries the hammer. The coiled spring acts upon the tumbler at one end, and is at the other screwed to a plate on the opposite side of the stock, which is bored through to receive the shaft and its spring. The claim is to "the manner in which I have applied and combined the helical, or spiral, main spring, with the tumbler, hammer, and other parts of the lock."

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85. For an improvement in the *Safety valve for regulating the pressure of Steam in Steam boilers;* John Hadley, Bennington, Gennessee county, N. York, March 10.

Like most of the contrivances for the purpose of showing the pressure of steam, the contrivance here described will fail in accomplishing its object, as its indications are to be given by the sliding of a tube through a stuffing box in the top of a boiler.

There is to be a vertical shaft, or rod, ten feet, more or less, in length. The lower end of this rod is to be cylindrical, and tubular, opening into the boiler, and working in a stuffing box. This rod is to be pressed upwards by the expansive force of the steam, and when it rises to a certain height, so as to bring a lateral opening into its tubular part, above the boiler, the steam will escape through it. The upper end of the rod acts upon a horizontal shaft turning on gudgeons, and carrying an index at one end, to point out the degree of pressure. This shaft also raises a weighted arm, or lever, which may be loaded in any degree desired, by the shifting of the weight; said arm, or lever, hangs vertically when there is no pressure of steam. The claim is to "the manner of showing the degree of pressure of steam, and the manner of giving vent to the steam, at the pressure desired, in combination, as above described." There is not any thing in *the manner* of constructing this apparatus to redeem it from that failure which has been the doom of several analogous contrivances. It is not possible to cause a piston to work steam tight, and with an equable resistance at all times, through a stuffing box; nor does this device touch the main cause of steam boiler explosions, namely, a sudden generation of steam, in which case the sliding shaft would be of no more avail than it would be if applied to a piece of ordnance.

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86. For a *Machine for smoothing Type;* David Bruce, Jr., Bordentown, county of Burlington, New Jersey, March 10.

87. For a *Machine for Casting Printing Type;* David Bruce, Jr., Bordentown, county of Burlington, New Jersey, March 10.

The two above named machines do not admit of description without the accompaniment of illustrative drawings. To these the claims refer, and they would not, therefore, alone, convey any adequate idea of the machinery patented.

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88. For an improved *Cooking Stove and Oven;* John R. Smith, New Haven, New Haven county, Connecticut, March 10.

An oven, the outer casing of which is double, so as to admit heated air to circulate around it, is connected by means of a pipe with a cylindrical or other stove, so that the heated air from the latter may heat the former; there is not any thing of a very special character to present, and the claim made is confined to the manner of constructing and combining with a stove of any suitable kind, an oven formed and operating substantially in the manner set forth.

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89. For an improvement in the mode of making *Cast Iron Wheels for Cars,* to be used on rail-roads, and applicable also to other purposes; Henry Mooers, Beaver Meadow, Northampton county, Pennsylvania, March 10.

The claim under this patent is to "the mode of chilling the hubs, by means of the combined chills, so as to make a car wheel with a solid hub, without their straining, or being liable to break."

As this patent has been virtually repealed by the decision of a special board of examiners under the provisions of the patent law, who have ordered a patent to issue for the same thing, to Mr. Hopkin Thomas, of Beaver Meadow, who was, in the opinion of the board, the original and first inventor, we shall not give a description of the thing patented until we arrive at that of Mr. Thomas, in due course.

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90. For a *Machine for Sawing Eave Troughs,* for conducting water from buildings; Jira Wing, Hancock, Addison county, Vermont, March 17.

Two circular saws are to be placed upon shafts, so as to stand at right angles, or at any other suitable angle, from each other, and to meet, or nearly so, at their edges; these saws are to be driven by suitable gearing to cut the stuff from which the trough is to be made, said stuff being supported on a suitable carriage.

The particular construction of this machine is a point of little importance, as any handy machinist would be able to make one, without any further information than that above afforded. The claims made are to "the arrangement of the saws in their respective frames; the method of setting and regulating the saw frames, the combination of the two saws; and the method of operating the carriage, all as described."

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91. For a *Revolving Spring Punch;* Solyman Merrick, Springfield, Hampden county, Massachussetts, March 17.

This punch is for making holes in leather, and is made in some respects like the ordinary spring punches for that purpose, that is, with two handles,

and a spring to open them, like sugar nippers. Instead of a single punch screwed into one of the jaws, and made to act on a strip of copper on the opposite jaw, there are several punches, usually four, of different sizes, which are screwed into a hollow hub, and stand out like radii, or the spokes of a wheel. This hub is received into one of the jaws, within which it revolves, thus allowing either of the punches to be brought into the position for cutting against the antagonist jaw. That which contains the hub, is slit, so as to constitute spring cheeks, having hollows to embrace the sides of the punch in use, and hold it in its place. We have one of these instruments, and find it convenient for various purposes; the four sizes of holes are obtained instantaneously by merely turning the punches round, and it is altogether a very neat and pretty article. The claim is to "the combination and arrangement of the elastic shanks, or sides, of the lever, and the circular grooves, or catches, as set forth."

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92. For an improvement in the mode of making *Cast iron Car Wheels*, to be used on rail-roads, and applicable to other purposes; Jonathan Bonney, Charles Bush, and George C. Lobdell, Wilmington, New Castle county, Delaware, March 17.

(See Specification.)

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93. For an improvement in the *Self-Sharpening Plough;* John Ormiston, Center, Morgan county, Ohio, March 17.

The claim under this patent is to "the peculiar form and construction of the double point, and the mode of fastening it, as described."

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94. For a machine for *Punching and Shearing Iron;* Lemuel T. Pope, Boston, Massachusetts, March 17.

There is nothing worthy of special notice in this patent, which is taken for combining together the common shears for cutting sheet metal, and a punch for punching holes therein. The claim is to "the combination of levers, and the arm and follower, as set forth."

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95. For an improvement in the mode of making *Cast-iron Wheels to be used on rail-roads*, and which are applicable to other purposes; Samuel Truscott, George Wolf, and James Dougherty, Columbia, Lancaster county, Pennsylvania, March 17.

(See Specification.)

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96. For an improvement in the *Platform Balance for Weighing*; B. Morrison, Milton, Northumberland county, Pennsylvania, March 17.

The numerous modes in which platform balances have been modified appears to leave little room for any great change in their construction; and it seems to us that there is but little to be desired, those which are in use being, in many instances, equally convenient and accurate. The claim in the present case is to "the application of the parallel principle to a lever of the second kind, (viz. to a beam having its weight between the fulcrum and the power) for the purpose of weighing; and the combination described whereby the points or edges of the main lever are at any time capable of

being freed from the pressure of the platform and what may be laid thereon, and the platform at the same time be made to rest firmly and securely upon the supporters, or posts, beneath the same."

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97. For an improvement in the machine for *Crimping leather Boots;* Collins H. Jaquith, Keene, Cheshire county, New Hampshire, March 21.

This machine very closely resembles some others previously patented. The leather is placed on a former, upon which it is to be crimped by causing it to be pressed in between two jaws, which are furnished with thumb screws to regulate their distance apart. These, and a strap attached to a ratchet wheel to strain the leather upon the former, constitute the novelties claimed.

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98. For a mode of preparing a *Composition for Fuel,* by the aid of calcareous cements; John Allen, city of New York, March 17.

(See Specification.)

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99. For an improvement in the *Furnace and Pots for Melting Metals;* Silas Grilley, Waterbury, New Haven county, Connecticut, March 17.

(See Specification.)

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100. For improved *Backs for Forges and Furnaces;* Luke Wilder, Leominster, Worcester county, Massachusetts, March 17.

This forge back is to be of cast-iron, and is to be perforated so as to receive a cast-iron tube, which is to constitute the aperture, through which the wind is to be blown. Two, three, or more tubes of different sizes may be adapted to the same back, and be changed according to the nature of the work to be done. Particular directions are given respecting what is deemed the best form of the respective parts, and a claim made to "the back, and the tubes, and the form thereof, their adaptation to each other, and their uses, as set forth."

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101. For improvements in the *Furnace for Smelting Iron with Anthracite;* Joseph Baughman, and Julius Guiteau, of Mauch Chunk, Northampton county, Pennsylvania, March 21.

(The Specification will appear hereafter.)

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102. For an improvement in the *Fishing Sein for deep water;* Russell Evarts, Madison, New Haven county, Connecticut, March 21.

This patent is taken for a particular form of sein, in combination with the boats and floats, arranged and employed in the manner described, for the purpose of fishing in deep water. The subject matter is not of that general interest to justify the long detail which would be necessary in order to describe the affair, without a drawing; few fishermen, we apprehend, read our lucubrations.

103. For improvements in the mode of making *Metallic Pens, or instruments for writing;* Henry C. Windle, Joseph Gillott, and Stephen Morris, of the kingdom of Great Britan, March 21.

The claims under this patent are to "the elastic and adjustable finger and thumb plates, whether applied to pen holders, or pens, or other such instruments for writing. The introduction of the double arch, one in each nib of the pen, in manner, and for the purpose described.—The new channel pen feeder, made separate from the pen, and attached thereto when in use, by means of a slide ring, for supplying ink to the point of the pen, as described." The things set forth are illustrated by nineteen separate figures in the drawings. The finger and thumb plates have a curious appearance, projecting out from the penholder something like the keys of a flute; we think it very probable that a little practice with them may prove them to be useful contrivances, although they may at first be used as awkwardly as a knife and fork by a savage. These and the other things claimed will undoubtedly soon find their way into the market, should they prove to be good, as Windle and Gillott's pens, are every where to be found.

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104. For improvements in the mode of making *Spiral Springs for belts, pantaloons, vests, &c.;* Walter Hunt, city of N. York, March 21.

Flat spiral springs are to be formed by winding steel wire round a piece of hoop iron, or other suitable former; the coils of these springs are to be about one fourth of an inch apart, and the two ends of the wire are to be bent so as to "form hooks and tongues." "In this last forming of the tongues upon the opposite ends of the spring consists the novelty and utility of the invention, inasmuch as it affords the most simple and advantageous means of attaching the spring to straps, &c., in such manner that it may act by extension, and perform the twofold office of spring and buckle."

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105. For a machine for *Thrashing grain, hulling clover seed, shelling corn, and for other purposes;* Horatio N. Waterhouse, Butler county, Kentucky, March 21.

The novelty in this apparatus consists in placing the concave of a cylinder thrashing machine upon a movable apparatus, so that by raising or depressing a bar, it may be brought nearer to, or removed further from, the revolving cylinder, and be thus adapted to the performance of the respective operations. The claim is to "the movable bar of the concave for regulating the feed of the machine, for shelling corn, hulling clover seed, or thrashing grain.

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106. For improvements in *Boxes and Axles for Carriages;* James A. Smith, New Haven, Connecticut, March 23.

"The object of this invention is to lessen the friction, or to prevent oil from escaping. This I effect by making a friction washer, and thereby an oil preserver, a constituent part of the box on the outward end, instead of the common friction washer on the axle at the other end of the box."

What is called a friction washer is an interior flanch on the front end of the box, forming a shoulder against which the shoulder on the end of the axle is to press, and leaving an opening in the box sufficiently large for the screw

on the end of the axle to pass through, which is to receive the nut. The claim is to "the friction washer within, and making a constituent part of the box, and the corresponding shoulder on the axle, as specified and described."

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107. For an improved machine for *Excavating and removing Earth, in making Prairie fences;* James Sawyer, city of N. York, March 23.

In this machine the turf and earth are to be cut by a plough attached to a carriage drawn by animal power; from the plough the turf is to pass, unturned, upon an inclined endless apron, driven by the friction of the upper edges of the driving wheels; this endless apron is called the elevator, and from this the turf is to be delivered on to a second endless apron called an inclined plane, extending out to a considerable distance behind the elevator, and behind this is what is called the delivering plane, which swivels so as to carry the turf out of a direct line, and delivers it where it may be required.—The plough is to cut "a close furrow (say eighteen wide and five thick)" [inches we suppose]. The claims are to "The delivering plane and its arrangement, for depositing the turf upon the fence at any required height. The arrangement by which the inclined plane vibrates, so that the turf can be delivered upon the fence, although the main carriage and plough may be running twenty feet distance from it. The combination of the endless chain or band with the delivering plane and the excavator or elevator in the manner above described."

The description of this apparatus is very far from perfect, and appears to have been prepared before the actual trial of any such machine. This observation is founded on a conviction that a machine made from the description would not operate; its heavy load, and the manner of its transition being such as to produce a resistance which no animal power would advantageously overcome.

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108. For improvements in the mode of constructing a *Double hill side plough*, and converting the same into two single ploughs; Martin Rich, Ithaca, Tompkins county, New York, March 24.

"This hill side plough is of the kind which has two perfect mould boards and land sides connected together by their upper sides, or standards, and which are to be inverted in alternately passing backward and forward in the act of ploughing; but they are so constructed that they may be readily separated, leaving a perfect single plough; and forming a second by attaching the removed portion to another beam and handles prepared to receive it." The claims made are to "the manner of holding and securing the shifting handles by means of the arm; the manner of confining the two standards in the beam by means of a staple and wedge as described, and the converting the double into two single ploughs as described."

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109. For an improvement in the *Shot charger*, for measuring shot in charging guns; George W. Dobbins, city of Baltimore, March 23.

The claim made is to a "mode of measuring the charge in such way that all except the quantity requisite to constitute the charge shall run off and be separated from the charge; and the mode described of discharging the shot at once into the barrel of the gun, in connexion with the application of the principle above mentioned."

The plan is simple, and must answer the purpose intended. The shot bag fills the charging tube, as it hangs over the shoulder, the shot running into it through a lateral tube leading from that forming the mouth of the bag. When the shot bag is turned up for the purpose of charging, all the superfluous shot runs back into it by the same opening through which it entered; that constituting the charge remaining in a chamber below the opening; when the mouth of the charger is placed over the muzzle of the gun, and a valve opened by a thumb piece, the shot will fall into the gun by their own gravity. The instrument is made adjustable.

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110. For improved *Parlour and Kitchen Fire places;* John Hagerty, Monroe, Monroe county, Michigan, March 24.

This apparatus is represented in several drawings,and the claim is to certain special arrangements, not to be briefly described; in such cases, where engravings or cuts are necessary to the description, they will always be willingly inserted in this journal, should those interested think proper to supply them.

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111. For improvements in the machine for *Crimping Leather for Boots;* Joseph Adams, Fairhaven, Rutland co., Vermont, March 26.

This machine resembles that noticed at No. 95; but the jaws are used in a reversed positiou, and there is a difference in their manner of combination.

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112. For a machine for *Pricking Leather preparatory to stitching;* J. W. Briggs, and J. S. Carver, Painsville, Geauga county, Ohio, March 26.

The leather to be stitched is placed between the jaws of clamps, which clamps are attached to a slide at their lower edges. This slide is guided by grooves, and is made to advance by means of a rack and pinion, the latter being turned by a treadle similar to that frequently employed for holding the clamps together. The feeding is graduated by a ratchet wheel and pall, and as the clamps advance, the same treadle brings up an awl which pricks the leather, which awl is retracted by a spring. The claim is to "the method of pricking the holes by means of a sliding awl, operating in the manner substantially as above described; and the method of working and regulating the motion of the sliding clamps in combination as above described."

We think this claim good, but believe that it might, with safety, have been made still broader, including not merely the method described of working the sliding clamps, but the sliding clamps themselves, as we believe this to be a novel feature in Harness maker's clamps.

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113. For an improvement in the *Mode of applying Friction rollers;* Rollin Dickinson and Samuel G. Merriman, Southington, Hartford county, Connecticut, March 26.

"We do not claim as our invention, friction rollers as such; but we do claim as our invention and improvement the mode of supporting friction rollers in a tight box filled with oil, and working them in oil covered from dust or other foreign substances, as specified."

The gudgeons of the friction rollers run in a frame which is to drop into

an oil box reaching above these gudgeons, but not so high as to interfere with the bearing of an axle upon the peripheries of the friction wheels. Over the whole is to be a close fitting cover.

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114. For an improved *Porcelain or Earthenware Stove;* Joseph Smolenski, city of Philadelphia, March 28.

This stove is intended as a modification of the earthenware stoves used in Europe. The patentee says, "I do not claim to be the inventor of stoves of porcelain, or other kinds of pottery, nor of the device for establishing an upward and downward draught alternately; this having been frequently done in stoves formed of metal, but not, as I believe, in the manner herein set forth in such as have been formed of pottery. I claim as of my invention the forming the body of a stove of the kind herein described, of plates, or pieces of pottery of different thickness, duly graduated according to the pressure and temperature as set forth. I also claim the construction and use of the air tubes, made and operating as described."

There is much similarity between this and some of our iron stoves, as will appear from the foregoing. Our habits appear to be adverse to the employment of a more fragile material, and we very much doubt the success of an attempt to introduce those of earthenware into general use, and are not certain that the balance of advantages would be in their favour, upon a strict investigation of the merits of both.

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115. For an improved *machine to set saw teeth;* Norman Billington and Dyer Hutchins, Shaftsbury, Bennington county, Vermont, March 28.

The parts of this saw-set appear to be arranged in a novel manner, and the claims consist in "the combination of the jaws as described, with the handles, and the application of the same to the purpose of setting saws."

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116. For improvements in the mode of making *Metallic Combs;* Richard A. Ives, Bristol, Hartford county, Connecticut, March 28.

Metal combs in various forms and modes of construction have been the subjects of patents; in the present case the manner of construction is best adapted to those of the small tooth; the claim to novelty rests upon the manner of putting the pieces of metal, forming the comb, together. Sheet metal (German silver being preferred) is to be rolled to the thickness the tooth is intended to have, and this is to be cut into strips which are to be long enough for the length of a tooth and the width of the solid rib running along the middle of the comb. The strips so cut are to be placed side by side, lapping upon each other at their interior ends, so far as is necessary for the width of the rib; suitable pieces for end teeth are then added, and the whole are to be soldered together. Thin plates of the same metal, the length of the comb, and width of the rib, are to be soldered over the laps, on each side, and the comb to be worked off, and polished. Where but one row of teeth is desired, the ends of the strips are to be doubled over, to such length as shall equal the width of the back, which is then to be finished in the same manner with the double toothed comb.

The claims are to the mode of forming the ribs, or backs, of combs, and the strengthening them as above described.

117. For an improvement in the *Hydrostatic Press;* Edward Merrill, New Bedford, Bristol county, Massachusetts, March 24.

This patent is taken for the manner of constructing the frame work of the press, and the patentee says that the advantages possessed by his press over others, are that "they cost only about one-third as much as the hydrostatic presses now in use; inasmuch as it requires about 4,000 lbs. less iron to make one, and obviates the necessity of more than one pump for several presses; it takes up less room, and answers a better purpose." He then claims "the mode of connecting the piston with the follower, in the manner described." The particular mode of construction cannot be well made known without the drawings and references.

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118. For a *Machine for Carrying Straw from Thrashing Machines;* Uriah Beebe, Clarendon, Orleans county, New York, March 28.

This machine consists mainly of a number of revolving shafts crossing a trough, and carrying each a double row of long teeth, or fingers, which are to reach out nearly to the contiguous axles, and to pass between the teeth projecting from them. These being driven by suitable wheels and bands, or otherwise, take the straw in succession, carrying it from the thrashing machine to such distance as may be required. The grain is to pass through a screen, near to the thrashing machine. The claim is to the mode of carrying the straw, as described.

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119. For improvements in the machine for *Making Wrought Iron Spikes and Nails;* Richard Savary, Pittsburgh, Pennsylvania, March 28.

This patent is taken for the particular manner of arranging and operating the respective dies, and to this the claims are confined. These are not matters for verbal description.

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120. For an improvement in the *Straw Cutter;* William J. Duvall, city of Baltimore, March 28.

In this machine the feeding trough is made in the ordinary way, and the straw is to be cut by a knife working up and down at its fore end. This knife is moved by a particular combination of levers, which serve also to govern the feeding apparatus, consisting of rollers moved by a ratchet wheel and feed hand. The claims are to the particular manner of arranging and combining these parts.

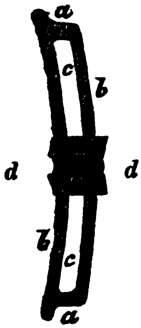
Specifications of American Patents.

Specification of a Patent for Cast Iron Wheels to be used on Rail roads; Granted to Samuel Truscott, George Wolf, and James Dougherty, *Columbia, Lancaster county, Pennsylvania, March* 17, 1838.

To all whom it may concern, be it known, that we, Samuel Truscott, George Wolf, and James Dougherty, of the Borough of Columbia, in the county of Lancaster, and State of Pennsylvania, have invented a new and improved mode of constructing cast iron wheels for rail-road cars, and for

other purposes; and we do hereby declare that the following is a full and exact description thereof.

We denominate our wheel, the *Double Plate Car Wheel*, because we use two plates, instead of the spokes, or arms, usually employed, which plates are cast with the rim, and form one substance therewith. We give to the rim of our wheels the same form in all respects as is now given to the rims of car wheels, but instead of arms we cast our wheels with two parallel, or nearly parallel, plates, which plates are convex on one side, and concave on the other; the hub, or nave, which is to receive the axle, is cast in the centre of these plates, extending from one of them to the other. The accompanying drawing gives a sectional view of one of our wheels, *a*, *a*, being the rim, *b*, *b*, the front and back plates, convex on one side, and concave on the other; *c*, *c*, being the hollow, or void space between them; and *d*, *d*, the nave, or hub. The hollow *c*, *c*, between the two plates is formed by a core, in the process of casting, which core is supported in the flask by leaving suitable holes in the plates for that purpose, which serve also for the removal of the sand of which the core is formed.



We cast our rim in a chill, in the usual manner, and in consequence of the particular form given to the plates, they contract in cooling without danger of fracture, and without its being necessary to divide the hub, as is done when car wheels are cast with spokes, or arms. The only effect of contraction is to flatten the two plates in a slight degree, operating in this respect like the curved arms of many cast-iron wheels.

We are aware that car wheels have been made with plates as a substitute for arms, but such plates have been made separate from the wheels, and united together by screw bolts, embracing the hub in a distinct piece between them. The difference between such wheels, and those constructed by us, is so obvious as not to need pointing out.

What we claim as our invention, and wish to secure by letters patent, is the manner of constructing wheels for rail-road cars, or for other purposes to which they may be applied, with double convex plates, one convex outwards, and the other inwards, and an undivided hub; the whole cast in one piece, as herein fully set forth.

Samuel Truscott,
George Wolf,
James Dougherty.

Specification of a Patent for an improved mode of preparing a Composition for Fuel, by the aid of Calcareous Cements. Granted to John Allen, *City of New York*, *March* 17*th*, 1838.

To all to whom these presents shall come, Be it known, that I, John Allen, of the city of New York, in the county and state of New York, have invented a new and useful composition of matter, to be used as fuel, and to be called *compound coal*, and that the following is a full and exact description thereof:

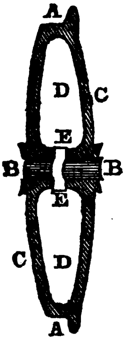
Take from eighty to ninety parts of coal dust or fine coal, such as makes from handling, breaking or sifting the anthracite or hard coal, or the dust of pit coal, with from ten to twenty parts of ground plaster or gypsum, as prepared for use as cement, and water sufficient to mix them to the con-

sistence of thick cream; then expose the mixture to the operation of a press, or to the air and sun, and in a few moments it will be sufficiently firm and dry to bear transportation. Immediately preceding the hardening of the cement, it may be easily cut into blocks or squares of any size or shape, with knives, or with a machine constructed for that purpose. As the cementing power of the plaster is expended very suddenly, and within one or two minutes after the water is applied, it is highly important, indeed, absolutely necessary, that the mixing should be performed with haste, so that it may be spread out and made level and smooth, ready for the press, or the cutting machine, at the critical moment. The time indicated for the application of the cutting knives or machine, by the appearance of the mixture, is by its assuming a rough appearance on the surface, by dropping into little holes as the water disappears. If the mixture is stirred or disturbed during the expenditure of the cementing power, it leaves it in mortar, and is unfit for use unless it is submitted to a heavy pressure, and exposed to the sun and air. Another form of the compound, is by the use of lime in the above proportions, instead of plaster. In which case less care is required in the process of compounding,—the cementing properties of lime being much slower and less powerful,—and therefore requiring more pressure, or if dried by evaporation, more air and sun. Another form is prepared by a combination of plaster and lime in various proportions, according to the power of the press, or the dryness of the atmosphere—the increase of plaster requiring less of either—the increase of lime requiring an increase of both. Another form is prepared by any of the above proportions, by adding to the coal dust from ten to twenty per cent. of the dust of Liverpool coal or other bituminous coal. Another form is prepared by the use of the above proportion of coal dust, in combination with from ten to twenty per cent. of cement, such as is used generally in hydraulic structures, and prepared in a variety of ways. This compound is ignited and used as any of the hard coals are used, as fuel. The inventor, in this case, *claims* having discovered, that the dust of hard coal, peat coal, or bituminous coal, may be, by combining it with *plaster*, or *gypsum*, or with *lime*, or with *cement*—or with *plaster and lime*, or with *plaster and cement*, or with *lime and cement*, in the proportions of from eighty to ninety per cent. of dust, with from ten to twenty per cent. of the other enumerated articles—may be put into such form, and by evaporation or compression, or by both, have imparted to it such solidity and other requisite qualities for transportation and combustion, that it may be used as fuel in any and in every machine in which coal is generally used.

JOHN ALLEN.

Specification of a Patent for an Improvement in the mode of making Cast-Iron Wheels for Cars, to be used on Rail Roads. Granted to JONATHAN BONNEY, CHAS. BUSH and GEO. G. LOBDELL, *Wilmington, New-Castle County, Delaware, March 17th,* 1838.

To all whom it may concern: Be it known that we, Jonathan Bonney, Charles Bush, and George G. Lobdell, of Wilmington, in the county of Newcastle, and state of Delaware, have invented an improvement in the manner of constructing cast-iron wheels for cars, to be used upon rail roads, and for other purposes; and we do hereby declare that the following is a full and exact description thereof. The accompanying drawing shows a section of one wheel, which, instead of arms as usually employed, has each face thereof convex, a hollow space being left between the two surfaces.



The rim of the wheel A, A, does not differ from those usually employed, and is cast in a chill in the ordinary manner. The rim is united to the centre, or hub, of the wheel B, B, by the two convex face plates C, C, which are cast in one piece with the rim and hub. The interior D, D, between the two convex face plates, is formed by cores, supported in a way well known to iron founders. The hub has a transverse division E, E, which separates it into two distinct parts, attached respectively to the face plates. This division is necessary to prevent the tension which would be produced by shrinkage in the casting, and which would endanger the breaking of the wheel. The hub, if preferred, may be cast solid, with the exception of the division E, and afterwards bored out; or it may be cored, and turned to receive the axle.

We are aware that wheels have been made with double convex plates, both of cast, and of wrought iron; but such plates were in separate pieces from the rims and hubs, being received into rebates on the rims, and embracing the hub between them, which extended through openings in their centres, the two plates being secured together by screw bolts; we are also aware that a plan has been devised for cast iron wheels with two face plates, having a space between them formed by cores, as in our method, but the two plates were in this case parallel to each other, one of them being convex, and the other concave, on its face, the hub extending from one face to the other in a continuous piece, rendering it necessary, on account of shrinkage, to place the two plates as described; an arrangement which sacrificed strength to necessity.

By constructing the wheel so that the plates shall both be convex outwards, as they are, in the position of the greatest strength, they may be made considerably thinner than would otherwise be admissible, and the wheel will consequently be lighter.

All that we claim as our invention, is the division of the hub into two parts, transversely, between two face plates, each convex outwardly, in the manner, and for the purpose, set forth.

Jonathan Bonney,
Charles Bush,
George G. Lobdell.

Specification of a Patent for Improvements in the Furnace and Pots for Melting Metals. Granted to Silas Grilley, *Waterbury, New Haven County, Connecticut, March 17th,* 1838.

To all whom it may concern: Be it known, that I, Silas Grilley, of Waterbury, in the county of New Haven, and state of Connecticut, have invented a new and useful improvement in the furnace and pots for melting metals for castings, or for other purposes, by which great saving of metal, of fuel, of time, and of labor, is obtained.

This I effect by appendages, simple in construction, and easily applied to furnaces and pots in common use.

To enable others skilled in the art, to make and use my invention and improvement, I describe the construction and operation as follows, viz:

The furnace may be round, or square, and of a size suitable for the pots intended to be used, and must be lined with fire brick, or other material, indestructible by fire, and having a grate at the bottom, the middle bar of

which should have on it an elevated stand about an inch high, for the pot to rest upon.

The pots I use may be of any size, and for large or small operations, and are in the common form, except that they should be made without a projecting lip, and of the materials in common use, or of any other that will stand the fire: and my improvement consists, principally, in placing on the melting pots, a top pot, or tube, open at both ends, about one-fourth longer than the bottom pot—in diameter, of the size of the lower pot where they join, and a little less at top, having a shoulder with a lip at the bottom, to fit, embrace, and rest upon the top of the lower pot, and is made of the same materials as the lower pot.

The object and peculiar use of the top pot, or tube, is to enable the operator to charge both pots with metal sufficient, when fused, to fill the lower pot as it melts and descends; thus preventing the necessity of opening the furnace to introduce cold metal, and the waste of time occasioned thereby; and while the fuel in the furnace surrounds both pots on the outside, all coal may be excluded from the inside of both.

The furnace may be covered with folding doors, closing around the upper pot, or tube, or it may be held steady in place, by a ring around the tube, having branches hooked to the sides of the furnace. The top of the tube may be covered with a movable lid, to exclude coal when feeding the furnace.

My object is to confine the heat, and to give easy and direct access to the lower pot for the occasional supply of metal when necessary for compounding, or otherwise, without interfering with the fuel, and to prevent the waste of metal by such interference, and the loss of time and labor by the usual mode of feeding.

After the metal is all fused, the top pot, or tube, may be taken off, and a flaring piece or hopper, having an open orifice in the centre, of the size of the melting pot, made of the same materials as the pots, and fitted with a lip, to the top of the lower pot, and flaring upwards nearly to the sides of the furnace, may be placed upon the top of the pot, thereby confining the heat around the pot and preventing the loss of metal by swashing, while stirring the melted mass to mix and amalgamâte the metal—a necessary operation, and often attended with loss.

I claim as my invention and improvement:

1st. The upper pot, or tube, as described, and its application and uses for the purposes specified.

2d. I claim the flaring piece, or hopper, as described, and for the uses and purposes as specified;—and for these improvements severally, and for each in combination with furnaces and pots for melting in common use, as specified, I solicit letters patent.

SILAS GRILLEY.

On uniting the Leaves of Books by means of Caoutchouc, instead of by Stitching, in the ordinary manner.

We some time since published the specification of a patent for an invention made in England, consisting in the employment of caoutchouc varnish for uniting the leaves of books, instead of by sewing. It seems just and proper to give publicity to the following report, as containing, it is believed, the original suggestion of this process. There is not any idea entertained

that the invention in Great Britain was not also original, as there was not any extended publicity given to the process of Mr. Breed.

Hall of the Franklin Institute, Philadelphia, January 8th, 1835.

The committee on science and the arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the mechanic arts, to whom was referred for examination, a method of bookbinding, invented by Mr. Samuel D. Breed, of Philadelphia:

Report, that this invention consists in the application of a cement or paste, made by dissolving gum elastic in an essential oil, to the back of the book, so as to supersede the necessity of stitching. To effect this the folds at the back of the book must be shaved off so as to lay the edges of all the leaves bare, and the cover of the book applied and cemented with the solution of gum. The advantage which Mr. Breed expects to derive from this invention are, diminished cost of binding, greater durability in consequence of the elasticity of the back, and greater fitness for re-binding, as the gum cement will occupy much less of the margin at the back than stitching does.

The few and imperfect experiments made by Mr. Breed, do not furnish to the committee sufficient ground for an opinion relative to these supposed advantages. But they observed a peculiarity in the book exhibited to them which deserves especial notice, which is, that the book would lie open at any page without constraint, in consequence of there being no stitching to cause its leaves to spring together.

The committee are inclined to believe that when properly matured, this may prove to be a valuable improvement in the art of bookbinding, and therefore advise Mr. Breed to test its utility by further trials.

By order of the Committee.

WILLIAM HAMILTON, Actuary.

Progress of Practical and Theoretical Mechanics and Chemistry.

Kyan's Patent for Preventing Dry-Rot.

Having been prevented attending at the opening of a fungus pit in the Anti-Dry-Rot Company's Yard, David street, on Wednesday last, we take the following account from the *Manchester Chronicle* of Saturday:

"Amongst the articles placed in the pit [Nov. 7th, 1837,] were various kinds of timber in thin boards, prepared with the anti-dry-rot solution, ropes, twine, sacking, and canvass; and articles in an unprepared state, but corresponding in every other respect with those which were prepared, were also deposited therein, in order that the action of the anti-dry-rot process might be the more satisfactorily shown. The pit was closed in the presence of several gentlemen who signed a certificate to that effect, and the key of the padlock by which it was secured was placed in the hands of Mr. Hawkshaw, of the Bolton Railway. On Wednesday last, the 7th instant, the pit was opened in the presence of a numerous body of gentlemen, amongst whom were Samuel Evans, Esq., the boroughreeve, George Wood, Esq., and J. Woollam, Esq., the constables of the town, several eminent architects and builders, including Mr. D. Bellhouse, jun., Mr. T. W. Atkinson, Mr. Tattersall, Mr. Wallis, and Mr. Edwards, and many gentlemen who felt interested in the success of the experiment. It may be necessary to state, perhaps, that the bottom of the pit was thickly strewn with pieces of wood, which the dry-rot had reduced to a state of decomposition, and every facility

was given, in the manner in which the articles were deposited, for communicating the infection to the prepared as well as to the unprepared. The result, we are happy to say, was quite as successful as could have been anticipated by the parties who made the experiment. With respect to the timber, which consisted of spruce deal, soft American elm, poplar, American ash, American birch, and American oak, the boards which had been submitted to the Kyanising process were found to be perfectly sound and untainted, while those which were unprepared exhibited in various degrees the progress of the disease. The American oak, in particular, afforded most satisfactory proof that the value of the process has not been overrated. The prepared plank was of a fine dark colour, without the slightest symptom of decay, while the unprepared was rotting away most rapidly. A piece of very coarse wrapper, such as is used for nail-bags, was reduced to a state of decomposition, while the corresponding piece, which had been Kyanised, was sound in every part except at the edges, where it is supposed it had not been properly saturated. Another specimen of wrappering, and some soft packing-rope, unprepared, were completely decayed, while the corresponding pieces were as sound and perfect as on the day they were put into the pit. Two balls of thin twine exhibited the effects of the principle perhaps more forcibly than any of the other articles, the unprepared being reduced to a lump of manure filled with small red worms; while that which had been prepared was perfectly sound, and apparently stronger than ever. The only point in which the experiment could be suspected of having failed was in the case of a very thick piece of rope, which was decayed at the ends, although it had been immersed in the tank; on inquiry, however, we find that the rope was merely dipped in the solution, and not satured as it ought to have been; and therefore, the experiment, so far as this is concerned, cannot be considered a fair one.

"It was objected by one of the architects who witnessed the opening of the pit, that the pieces of timber were not large enough to test the preparation, and he expressed some doubts as to the possibility of saturating a large beam. The answer to this objection, we think, is easy; the object of the experiment was to ascertain whether Kyanised timber is capable of resisting the infection of dry-rot, and whether the piece used be large or small, appears to us to be quite immaterial. It is a fact proved beyond the possibility of doubt, that timber, of any thickness, may be saturated with the solution; but the use of thick timber in an experiment like this could not have produced satisfactory results, unless the pit had been allowed to remain closed for two or three years. The doubt, however, will now be most effectually met by another experiment. The timber taken out of the pit was again replaced in it yesterday, together with some pieces of a thicker description, and some bleached calico, and it will not be opened again until twelve months have expired. We had almost forgotten to mention, that an old silk handkerchief, which was put into the pit, after being dipped in the solution, was found to be unimpaired, not only in texture, but in colour."

Mining Journ.

On a new Voltaic Combination. *By* W. R. Grove, Esq., M. A.

On first hearing of porous porcelain being employed as a diaphragm for preventing the mutual precipitation of the metals on each other in voltaic combinations, it struck me that one of the plates of the metals usually employed might be dispensed with by precipitation upon the other from a me-

tallic solution. After some unsuccessful trials, I constructed a trough as following: a piece of common, stout millboard of the length required, and of breadth sufficient to form the bottom and sides, is separated lengthwise into three parallel divisions by cuts one-third through; it is then covered with a thin layer of cement and bent up into the form of a trough; four-inch squares of common sheet iron and unglazed porcelain plates of the same dimensions are then warmed and slid alternately into the trough, as in Cruickshank's form, at about three-tenths inch distance.* A solution of sulphate of copper and dilute acid being poured into the alternate cells, a very active series is formed by the precipitation of the copper on one surface of the iron; that which I formed was of twenty plates: the shock, without coils or condenser of any description, was so powerful as to be scarcely tolerable, when a wire was scraped along the edge of the plate at one extremity, the other hand touching the opposite end. The decomposition of water was also rapid, though I have not yet accurately measured its powers: its action continued unabated for nearly three hours without the addition of any acid or sulphate. If greater constancy be required, the alternate cells can be filled up with coarsely powdered sulphate, and some added as required. I was fearful that upon a second trial the intensity would have much abated, in consequence of the oxidated surface of the plates preventing so uniform a deposition of the precipitate, but was gratified to find that, after having been suffered to dry and remain at rest for several days, its action was as intense and constant as upon the first trial. The advantage of this form, where series and sustained power are required, I consider to be its extreme economy, a single cheap metal being employed instead of two expensive ones; the greater durability of iron as compared with zinc; the cutting in squares, so that none is wasted; and the tiresome process of soldering being altogether dispensed with. The diaphragms and solutions are common to every form of constant battery: possibly very thin plates of deal might do as well as porcelain; the durability of the latter material, however, makes its expense unimportant. My object in this communication is not so much to vaunt this particular form of battery as to direct increased attention to the porous filter as likely to form an important element in the analysis of the voltaic trough: it may possibly throw some light upon the organization of the torpedo. W. R. GROVE.

Swansea, Oct. 26, 1838. Lond. & Edin. Philos. Mag.

"*On the relative attractions of Sulphuric Acid for water, under particular circumstances; with suggestions of means of improving the ordinary process of manufacturing Sulphuric Acid.*" *By* HENRY H. WATSON, Esq., *Corresponding Member of the Manchester Philosophical Society. Communicated by* JOHN DALTON, D. C. L., F. R. S., &c.

The object of the inquiry detailed in the present paper is to determine at what degree of concentration the affinity of sulphuric acid for aqueous vapour is equal to that of anhydrous space for the same vapour at given

* Pasteboard is preferable to wood for the formation of these troughs: it has not strength sufficient by its warping to crack the cement, is much more easily constructed, and is a better insulator; it should be thinly coated with varnish on the outside to prevent capillary absorption by accidentally touching liquids. The plates of porous ware here mentioned may be conveniently employed for rendering constant the common Cruickshank trough, being warmed sufficiently to melt the cement and slide into the cells.

temperatures. It has long been known that concentrated sulphuric acid abstracts moisture from the atmosphere, but the amount and the rate of this absorption have never been ascertained with accuracy; and consequently, in applying this acid to purposes of exsiccation, the experimenter has often been at a loss to know whether the acid was sufficiently strong to render the space in which it was confined perfectly anhydrous. By placing portions of the acid, previously weighed, and diluted with known quantities of water, under the receiver of an air-pump, with equal portions of concentrated acid, of the specific gravity 1.8428, in similar dishes, the author ascertained that the dilute acid could be concentrated to the specific gravity 1.814, at a temperature varying from 65° to 57°: whence he concludes that acid of such strength is capable of drying a vacuum when the temperature does not exceed 57°. By making similar experiments in air, the author compared together the weights lost by ten grains of dilute sulphuric acid of the specific gravity 1.135, at three different periods of the day for six days, taking note of the dew-point and the temperature; and infers that when the affinity of space for vapour, or the evaporating force, is equal to 0.15 of an inch of mercury, it is just able to balance the affinity for water of sulphuric acid of the specific gravity 1.249.

The author next instituted a series of experiments to ascertain whether the evaporation of water from dilute sulphuric acid is capable of being carried on to the same extent in air as in vacuo, and found that the evaporating force of air exerted upon such acid is less than that of a vacuum at the same temperature. He observes that his experiments offer conclusive evidence that the evaporation of water is not owing to the existence of a chemical affinity between the vapour of the liquid and atmospheric air; but thinks that they favour the notion that the obstruction to this process in the open atmosphere is rather owing to the pressure than to the *vis inertiæ* of the particles of air. He is also of opinion that improvements will hereafter arise from this inquiry with regard to the economical management of the process of manufacturing sulphuric acid, which process would be greatly expedited by the regulated admission of steam into the condensing chambers kept at a constant high temperature. Ibid.

On the process for obtaining the Bichromate of the Perchloride of Chrome, as viewed under the Microscope. By the Rev. Edward Craig, F. R. S. E.

I observe in your number for July, p. 78, a notice of the bichromate of perchloride of chromium, and of the process for obtaining it. It may perhaps be interesting to call attention to the exhibition of this process under the microscope, which certainly throws some light upon the action going on. It presents one of the most beautiful objects ever seen.

Put a very small portion of the muriate of soda on a thin flat glass, and add to it a drop of strong solution of bichromate of potass; lay this on the port-object, and adjust it to the focus of the microscope. Then place upon another flat glass a drop of sulphuric acid, and turn it down upon the other glass. The action commences. The sulphuric acid is seen attacking and breaking down the muriate of soda and setting free the muriatic acid. Crystals of sulphate of soda are speedily formed. The sulphuric acid acts also on the bichromate of potass, and sets free the chromic acid; crystals of sulphate of potass are also formed. Over these crystals of both kinds a multitude of green particles are observed, which are probably a chromate of potass, formed from one equivalent of the chrome in the bichromate, and

then the other equivalent of the chrome combines with the disengaged chlorine, and appears in large blood-red globules over the whole field. The operation when steadily watched is very beautiful; and it is one in which the microscope seems to develope with peculiar interest a process whose specific features are lost sight of in the retort. According to the view which is thus given of the process, it seems natural to call the product chlorochromic acid.

Ibid.

March of Steam.

As the year 1838 will most assuredly form a remarkable epoch in the history of steam navigation, it may not be thought uninteresting to trace the advances it has made since the year 1814, when one steamboat, of sixty-nine tons burden, floated in solitude on the British waters. The following authentic account of the number and tonnage of steam-vessels belonging to the British empire (including the plantations) from 1814 to 1836 inclusive, has been politely supplied to us by the secretary of the Liverpool Statistical Society:—

Year.	Vessels.	Tons.	Year.	Vessels.	Tons.
1814	2	456	1826	248	28,958
1815	10	1,633	1827	275	32,490
1816	15	2,612	1828	293	32,032
1817	19	3,950	1829	304	32,283
1818	27	6,441	1830	315	33,444
1819	32	6,657	1831	347	37,445
1820	43	7,243	1832	380	41,669
1821	69	10,534	1833	415	45,017
1822	96	13,125	1834	462	50,736
1823	111	14,153	1835	538	60,520
1824	126	15,739	1836	600	67,969
1825	168	20,287			

Mining Journ.

Increase of Steam-power in Lancashire and its immediate vicinity.

The following returns, which are taken from a Parliamentary document, will afford some notion of the astonishing progress which the cotton manufacture has made in Lancashire since the year 1835. From the most complete returns that have yet been procured of the steam power existing in the manufacturing districts, and which were furnished by the Inspector of Factories, it appears that the total steam power employed in the cotton mills of Lancashire and Cheshire was 24,597 horses. The increase since 1835, including the mills now in erection, is, according to the subjoined account, 17,413 horses, of which 2,036 are destined for purposes not connected with cotton manufacture, leaving 15,377 as the increase in the cotton manufacture alone, which amounts to 62 per cent. upon the power existing in the whole of the counties of Lancashire and Cheshire at the date of the former returns. The 2,036 horse power not destined for the cotton manufacture, is divided as follows:—

Collieries	592	Canal	200
Woolen manufacture	410	Brewery	15
Woolen and cotton do.	88	Iron forges	35
Silk ditto	74	Nail making	24
Linen ditto	38	Wood grinding	30
Machine making	351½	Timber sawing	30
Corn mills	67		
Paper mills	82	Total	2036½

Ibid.

LUNAR OCCULTATIONS FOR PHILADELPHIA, MARCH, 1839.					Angles reckoned to the right or westward round the circle, as seen in an inverting telescope. ☞ For direct vision add 180° ☜	
Day.	H'r.	Min.	Star's name.	Mag.	from Moon's North point.	from Moon's Vertex.
10	15	32	Im. 60 *a* Sagittarii	5, 6	94°	45
10	16	38	Em.		277	235
18	8	52	Im. 47 Arietis	6	50	103
18	9	24	Em.		337	27
22	12	13	Im. 47 Geminorum	6	67	122
22	13	10	Em.		258	311
30	13	4	N. App. ☽ & 68 Virginis 5, ☽ N. 0.′ 2			
31	15	17	Im. (1617) Bailey, Virginis	6	36	59
31	16	35	Em.		264	299

Meteorological Observations for September, 1838.

Moon.	Days	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inch's	Inch's			Inches.	
	1	73	81	29.62	29.63	W.	Moderate.	.04	Cloudy—flying clouds—rain.
	2	56	69	84	84	N.N.W.	Calm.		Clear—do.
	3	47	68	30.12	30.12	N.E.	Brisk.		Clear—do.
🌕	4	59	74	13	15	N.E.	Calm.		Clear—do.
	5	60	85	12	12	E.	do.		Clear—do.
	6	66	84	12	15	E.S.E.	do.		Clear—do.
	7	62	84	15	05	W.S.W.	do.		Lightly cloudy—clear.
	8	61	81	05	05	W.N.W.	Brisk.		Clear—do.
	9	64	78	10	10	S.E.	Calm.		Cloudy—clear.
☽	10	59	78	03	03	S.S.E.	do.		Cloudy—clear.
	11	64	74	29.86	29.86	S.	do.		Heavy fog—cloudy.
	12	63	58	94	64	N.E.	Blustering	4.00	Rain—do.
	13	60	72	54	81	W.	do.		Flying clouds—clear.
	14	56	74	30.05	30.10	W.	Calm.		Clear—do.
	15	59	77	04	04	W.	Moderate.		Flying clouds—clear.
	16	60	69	04	04	N.E.	do.		Lightly cloudy—do. do.
	17	59	69	29.85	29.8	N.	Brisk.		Cloudy—do.
⊗	18	64	76	11	64	N.N.E.	Calm.		Cloudy—clear—eclipse of sun.
	19	62	71	72	72	W.	do.		Lightly cloudy—clear.
	20	53	67	90	91	N.W.	do.		Lightly cloudy—cloudy.
	21	62	73	93	91	E.N.E.	do.	.09	Rain—cloudy.
	22	68	80	84	84	S.W.	Brisk.		Cloudy—flying clouds.
	23	72	54	73	73	SW.N.	do.	.44	Showery—do.
	24	46	64	30.00	30.00	W.	Calm.		Clear—do.
	25	48	68	13	13	S.E.	do.		Clear—lightly cloudy.
☾	26	59	63	17	13	E.	Brisk.	2.33	Stormy—rain.
	27	59	66	10	10	N.E.	Calm.		Cloudy—do.
	28	64	78	08	00	N.E.	do.		Cloudy—do.
	29	68	65	29.80	29.70	N.E.	do.	.40	Rain—cloudy.
	30	55	69	86	91	N.	do.		Flying clouds—do. do.
	Mean	60.23	71.97	29.95	29.91			7.30	

	Thermometer.	Barometer.
Maximum height during the month.	85. on 5th.	30.17 on 26th.
Minimum " " "	46. 24th.	29.62 , 1st.
Mean	66.10	29.93

JOURNAL

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State of Pennsylvania,

AND

MECHANICS' REGISTER.

FEBRUARY, 1839.

Practical and Theoretical Mechanics and Chemistry.

Analysis of some of the Minerals found at Karthaus and Three Runs, on the West Branch of the Susquehanna River, Clearfield County, Pennsylvania. Accompanied by a section of the mineral ground. By Professor W. R. Johnson.

With a view to obtain a more exact knowledge of the resources of Pennsylvania for mechanical and manufacturing industry, than is to be procured from existing publications, or other available sources of information, the writer, in the spring, summer and autumn of 1836, made an extended tour of observation and exploration through various counties of the state, and particularly through the region bordering the West Branch of the Susquehanna River. In the course of four months spent on that stream and its numerous tributaries, he was led, among other situations, to visit the establishment at Karthaus, at the mouth of the Little Mushannon Creek, then the seat of operations of Messrs. Ritner and Loy, and since occupied by the Clearfield Coke and Iron Company, under a charter from the state. He had previously examined a specimen of the bar iron manufactured by puddling from the pig metal made at the Karthaus furnace. This specimen was found to possess a strength of 58.500 pounds to the square inch. The pig metal was gray No. 2, and had been tested at Harris' foundry at Bellefonte, where it was understood to have been found equal, for foundry purposes, to much of the iron of Centre county. At the time the metal in question was made, the ores used at the furnace were derived from two different banks, one denominated the "kidney vein," a *bed* constituting part of the regular horizontal formation in Mushannon hill, on the north side of the Susquehanna River, 344 feet above the level of the stream; the other called the "Old Barn Bank," on the Smethport turnpike, in a northerly direction from the furnace. These ores were employed in the proportion of *two* parts of the former to *one* of the latter. This bank is probably the

remains of one or more of the regular beds, and is found in the form of shell ore, or the hydrated peroxide of iron, with some earthy impurities. The ore then taken from the *kidney vein* was also, in part, in the same state, but was much mixed with the solid argillaceous carbonate, which had not undergone any change from exposure to atmospheric influences.

It may be added, that on the site now occupied by the company, a furnace for smelting iron with charcoal formerly existed, the ores for which were derived from the same banks as those first worked by Messrs. Ritner & Loy, and that with these materials good foundry iron was made.

Since the period of the visit above referred to, a considerable bed of iron ore has been discovered, about 80 feet lower in the formation than the kidney vein, or only 264 feet above the level of the river. This ore is chiefly in two *bands* of 9 and 16 inches in thickness respectively. Its position in the formation, and its regular and almost uniform character, as contrasted with that of the kidney vein, induced, it is supposed, a desire to substitute, in part, the ore of this new bed for that of the one previously relied on.

In the year 1838, therefore, the supply for the furnace was taken in equal quantities from the "kidney vein" and the "*red vein*," as this new bed has been called, and the consequence has been the production of pig metal different in character and appearance from that already described.

This circumstance induced the company to request that an examination should be made of the grounds, and trials of the ores instituted, to ascertain the value and suitableness of the several materials, for the manufacture of iron.

In compliance with this request, a visit of several days continuance was made in October, 1838, not only to Karthaus, but also to Three Runs, a point six miles lower on the river, where the company possess a tract of 1100 acres of land, lying for three miles along the northern bank of the river.

The general character of the geological formation appearing to be nearly the same in the two places, gave reason to anticipate a similarity in the minerals, and this, with such variations as are well known to belong to a large coal field, will be justified by the explorations already made.

The property here owned by the company will be found to possess a much greater quantity of ground containing the upper thick bed of coal than that which they hold on lease at Karthaus. They have also access above water level to some of the measures which at the latter place, are probably under the bed of the river. The analyses, it will be perceived, are direct, and do not profess to take cognizance of the exact relations of all the minor earthy impurities. Several trials in the humid way have however been made, tending to the same general conclusions as those herein detailed. The absolute juxtaposition of iron ore, coal, limestone, firestone and fire clay, is a significant indication of the vast importance of the district of country to which the accompanying section, made from data furnished by the company, will be found to refer.

COAL.

The bed of coal chiefly relied on for making iron at Karthaus, is the upper or main bed, six feet thick, which lies 80 feet below the surface of the summit of Mushannon hill, and 479.94 feet above the level of Susquehanna river, as represented in the accompanying section.

This coal has a specific gravity of from 1.250 to 1.278. It loses in water, during the process of distillation . 0.6 per cent.

It loses in carburetted hydrogen and other volatile products	26.2
The earthy residuum, after complete incineration, is	5.05
Carbon in the coke . .	68.15
	100.

The coke made at the works is of medium hardness, and in all respects well adapted to the production of iron. The earthy residuum is composed of silex, alumina, and oxide of iron, with a portion of lime and a little magnesia.

IRON ORES.

Ten assays have been made on the ores found on the company's grounds, of which four were on that of the "kidney vein," at Karthaus, two on that of the "red vein," and four on the ores of different beds at Three Runs.

The "kidney vein" ore is found in different parts of a bed, marked on the accompanying section of Mushannon hill as No. 15, at an elevation of 344½ feet above the level of the Susquehanna river. It is 11 feet in thickness, composed of ferruginous and carbonaceous slate, with reniform and some stratified portions of argillaceous iron ore diffused through it, in all amounting to about 26 inches of ore. This ore bed has a stratum of coal one foot thick below, and another 3.16 feet thick immediately above it.

The ore is an argillaceous carbonate of iron, or clay iron stone of the miners.

Its specific gravity is from 3.206 to 3.397, varying with the part of the bed from which the specimen is taken.

Its colour is a bluish gray; fracture splintery, and occasionally conchoidal—the exterior of weathered specimens covered with a coat of yellowish brown hydrate of iron.

1. The first assay on a specimen having a specific gravity of 3.397, conducted in the dry way, gave—

Of water, at 320 degrees, . .	1.2	per cent.
Loss in carbonic acid, by calcination at a red heat,	26.68	
Metallic iron, . .	38.33	
Earthy impurities, silica, alumina, &c. .	16.67	

The pig metal obtained in this analysis was of a mottled gray complexion; its internal structure granular, crystalline, moderately tough, and of rather more than medium hardness; it is, however, readily acted on by the file; its specific gravity was found to be 7.726. The cinder indicated that no metallic oxide remained, or, in other words, that the maximum yield of iron had been obtained.

2. This trial was on a portion of the ore of the same bed as the preceding, but the specimen selected was a part of the shell of the carbonate, which in the outcrop assumes the character of a brown hydrate of the peroxide of iron.

Its specific gravity was 3.415.

At 320 degrees it lost, of water, .	3.9	per cent.
By calcination, . .	6.72	
The metallic iron is, .	50.6	
Earthy impurities, .	17.1	
Oxygen, . .	21.68	
	100.	

The pig metal obtained in this assay is very soft and tough; its fracture irregular; its color dark gray or mottled; structure granular, and rather less crystalline than in the preceding trial. The cinder is a transparent glass, with a slight rose-coloured tinge, indicative, perhaps, of the presence of a small quantity of oxide of manganese. The specific gravity of the pig metal was 6.24.

3. The next assay of the ore of this bed was made with a view of testing the efficacy of the limestone of Three Runs and of Karthaus respectively, as fluxes for the ore in question. The specimen now tried was without any portion of hydrate adhering to the exterior; its specific gravity was 3.206.

It lost, by calcination, water and carbonic acid,	27.42 per cent.
Assayed by 11.5 per cent. its weight of the limestone of Karthaus, it gave of metallic iron . .	36.1
Earthy impurities, silica, alumina, &c. .	26.17
Oxygen . . .	10.31
	100.

The pig metal was mottled throughout, moderately hard; fracture even, and nothing of crystalline structure was perceptible. Its specific gravity was 7.102.

The cinder is a transparent glass, with a tinge of purple.

4. The same ore, treated with the limestone of Three Runs, in the proportion of 11.35 per cent., gave of metallic iron 34.54 per cent.

And the earthy matter, including some protoxide of iron contained in the cinder, amounted to .	27.34
Oxygen . . .	10.70
To which add the loss by calcination as above .	27.42
	100.

The cinder was in this case of a dirty green colour, porous, moderately fusible, and rather tough; the pig metal white, with a few specks of dark gray, producing a slightly mottled appearance.

5. This trial was on the ore from the "red vein," which is 264 feet above the level of the Susquehanna river, 11.72 feet thick, in which are two separate bands of ore. It is marked on the Section as No. 25. Specific gravity, 3.421.

This is also an argillaceous carbonate of iron, with an intermixture of some pyrites in minute grains diffused through the mass, and having its interstices coated with sulphate of lime.

This and the following assay were intended to afford another opportunity of comparing the limestone of Karthaus and that of Three Runs, as well as to make known the character of the "red vein," the discovery of which is comparatively recent.

The colour of this ore is of a bluish gray; its fracture splintery, uneven; surface harsh to the feel; the sulphate of lime in some parts crystallized in thin plates, and in others efflorescent on the surface. In drying at a temperature of 250 degrees, it loses only 0.32 per cent.

In assaying this ore with the limestone of Karthaus, the latter was employed in the proportion of 13.75 per cent. of the raw ore.

The loss by calcination—water, carbonic acid, and sulphurous acid . . .	29.06	per cent.
Metallic iron . . .	35.91	
Earthy impurities, silex, alumina, and sulphate of lime	20.68	
Oxygen and other volatile products of fusion .	14.35	
	100.	

The cinder is black, covered with a pellicle of metal, and is difficult of fusion.

The pig metal is rather hard, brittle, and white. Its specific gravity is 6.787.

The presence of sulphate of lime had led me to suspect that of pyrites. During the calcination this became abundantly evident, by the application of suitable tests; and a careful inspection of fresh specimens subsequently detected minute crystals of sulphuret in the ore.

6. The same ore was assayed by the limestone of Three Runs in the proportion of 11.28 per cent. of the raw ore. It gave

Loss by calcination . .	29.06	per cent.
Metallic iron . .	36.07	
Earthy impurities, oxide of iron, &c. .	20.38	
Oxygen, and other gaseous compounds resulting from the fusion . .	14.49	
	100.	

The cinder was in this case in part of a dirty yellow colour, in part dark brown, opake, tough, and easily fusible. The pig metal did not vary in any important particular from that of the preceding assay. Its specific gravity, however, was 7.272.

7. The next assay was on the compact blue clay iron stone of Three Runs, found on a bench upon the slope of the hill—its elevation not exactly determined, nor the thickness of the ore bed certainly known, but apparently of a workable magnitude.

This is a compact ore, affecting in its fracture a conchoidal form, occasionally splintery. Its specific gravity is 3.130.

Care was taken to distinguish, in this experiment, between the amount of water and that of carbonic acid. The result was

Hygrometric moisture . .	0.27	per cent.
Water of composition . .	2.09	
Other loss by calcination . .	27.67	
Metallic iron . . .	33.81	
Earthy impurities, silica, alumina, &c. .	22.49	
Oxygen . . .	13.55	
	99.88	

The pig metal is tolerably soft, somewhat malleable, having a dark gray colour; partly crystalline structure, with a specific gravity of 7.00.

The cinder is of a dirty gray, inclining to green; porous.

8. A bank of ore has been recently discovered at Three Runs, lower in the formation than any at Karthaus, and near the level of the river. This stratum is presumed to be disclosed by the greater depth to which, at Three Runs, the river has cut its channel into the general mass of the stratification. The ore is in nodules, generally of small size, often not exceeding one or two inches in diameter. They consist, as usual, of a shell and nu-

cleus, the latter generally more or less decomposed, but sometimes found very compact at the centre.

The decomposed nucleus is often a white carbonate of iron, with an exterior rose coloured tinge; shell of a chocolate brown. The specific gravity of the shell part was found to be 3.445; that of the nucleus, 3.570.

The assay of both the shell and nucleus together gave the following results—

Hygrometric moisture	0.92	per cent.
Water and carbonic acid lost by calcination	20.60	
Metallic iron	52.42	
Earthy matter	9.32	
Oxygen	15.84	
Loss	.90	
	100.	

The pig metal obtained in this assay is of a dark gray colour, of great toughness, softness, and malleability, and would be suitable for foundry purposes. Its specific gravity is 6.540.

The cinder is a transparent glass, tinged with light pink.

9. The shell part of the above nodular ore was next treated by itself, and gave the following results, viz.

Water lost by calcination	12.70	per cent.
Iron	55.94	
Earthy impurity	8.21	
Oxygen	23.15	
	100.	

The limestone of Three Runs and the coke of Karthaus were used in making this assay, and the cinder obtained was a transparent glass of a reddish tinge, with a pellicle of metal on the exterior. It was easily fused. The pig metal is very soft and tough; its fracture uneven, with a display of occasional crystalline facets; its colour dark gray. Specific gravity, 7.01.

10. The last assay of the nodular ore was on the nucleus part, carefully freed from earthy matter, and from hydrate or peroxide. This nucleus had a specific gravity of 3.570.

It was found to contain of

Water	1.09	per cent.
Carbonic acid	30.41	
Metallic iron	38.22	
Oxygen	10.92	
Earths and trace of manganese	19.36	
	100.	

In this assay the metal was all obtained in small beads and particles—the cinder much mixed with them—and it has therefore been found necessary to estimate the last two ingredients from a knowledge of the first three items. The eighth assay being made on a specimen of ore partly composed of carbonate and partly of hydrate, gave, as might be expected, a result intermediate between those of the ninth and tenth.

LIMESTONE.

1. The limestone found in the Mushannon hill, at Karthaus, as seen at

No. 8 of the accompanying Section, 426.11 feet above the level of the river, and 3½ feet thick, possesses a specific gravity of 2.78.

It loses, by calcination, water and carbonic acid,	36.37	per cent.
And contains of dry lime . .	36.08	
" protoxide of iron .	6.97	
" silica . .	12.00	
" alumina and manganese .	8.58	
	100.	

In heating strongly, to expel the last portions of carbonic acid, the lime, previously reduced to powder, became partially agglutinated together, evincing an incipient fusion.

2. The limestone found at Three Runs has a specific gravity of 2.70; is of a yellowish colour, and compact structure.

It loses, by calcination, water and carbonic acid,	32.7	per cent.
And contains of dry lime . .	34.5	
Silica . . .	21.0	
Protoxide of iron . .	6.3	
Alumina, with a little magnesia .	5.50	
	100.	

The above analyses appear to point to the cause of the peculiar character of the iron, found to be produced in one or two of the recent blasts of the company's furnace. The ore of the "red vein" contains a portion of sulphur, which the treatment of the minerals before smelting did not expel. The above analysis of the ore of the "kidney vein" did not detect the same ingredient in the contents of that bed. In the earlier blasts of the furnace, the "red vein" ore was not used, and then the iron was gray, soft, and good. The *white* metal is believed to have been chiefly, if not entirely, produced, since the "red vein" ore has been mixed with the other. It appears that the lowest yield of the ore, either at Karthaus or Three Runs, is 33.8 per cent. of pig iron, and the highest, 56 per cent., very nearly; hence, unless extraordinary imperfection exist in the running of the furnace, the quantity of raw mine required for the ton of pig metal, ought in no case to exceed three tons; and it may probably be found that two and a half tons will often suffice for this purpose, especially when a portion of the outcropping ore is mixed with the more solid parts. The nodular ore recently opened at Three Runs, whether treated with pure carbonate of lime or with the limestone of its own vicinity, yielded an iron of excellent quality, and varying in quantity from 38 to 56 per cent. of the ore employed.*

A more minute analysis of the cinder and of the residuum of the coal, to determine the best proportion of the different ores, and the quantity of flux necessary for their reduction, may hereafter be requisite, in order to the economical conduct of manufactures. Enough, however, has been shown, to indicate the intrinsic value of the materials, the fitness of several of them

* The mean yield of the ores of Wales is 33 per cent., that of those in Staffordshire, 30 per cent.—See *Voy. Metallurgique of Dufrenoy and others*, p. 100.

By the mean of sixteen analyses by Berthier, the quantity of *protoxide of iron* in the carbonates of France was found to be 39.075 per cent., which corresponds to 30.4 per cent. of metallic iron; and by the mean of eight analyses of the carbonated ores in the neighbourhood of Glasgow, by Dr. Colquhoun, the quantity of protoxide is 42.82 per cent., equivalent to 33.3 per cent. of *iron.*—*Thomp. Min.* Vol. I. p. 446-7.

for making both forge and foundry iron, and the cause of unsuitableness in others under the present mode of treatment for the like employment. Other varieties of ore than those already named, are known to exist in the neighbourhood, and have been formerly employed in the manufacture of iron at Karthaus, when good foundry metal was produced. On the whole, there is no reason to suppose that the pig iron made at these works will necessarily be less valuable than that produced in other countries, where coal and iron occur in similar juxtaposition, and where immense quantities of the best forge and foundry iron are produced.

Physical Science.

Objections to Mr. Espy's Theory of Rain, Hail, &c., in a letter to Mr. Espy, by Mr. Graham Hutchison, *of Glasgow, with replies by* James P. Espy.

Dear Sir,—Last winter, I carefully read all the papers regarding your meteorological opinions, which you transmitted me. As I did not take notes of the various statements contained in them, I now put down the following remarks merely from recollection.

According to your theory, rain, hail, snow, waterspouts, landspouts, cross-currents of air, and barometric fluctuations, are all occasioned by one and the same cause, viz. upward vortices of air, produced and maintained by the same means, viz. heat evolved during the condensation of invisible vapour into clouds. And so far as I can ascertain from the documents transmitted me, you conceive that all these meteorological phenomena are never produced in any other way. Your theory is both simple and ingenious; but I find great difficulty in conceiving how the various meteorological phenomena presented to observation in this, and in other countries, can be reconciled therewith, or explained thereby. I shall state what appear to me to be imperfections in your theory, and objections that may be urged against it, just as they suggest themselves.

1st. I find no account given in your theory how the condensation of invisible vapour into cloud, which gives out the heat that occasions the upward aerial vortex, commences. And admitting, for the sake of argument, that rain is always, and only, occasioned by an upward aerial vortex, which, according to your theory, so far as I understand it, possesses the principle of self-perpetuation, I find no explanation given of how the upward vortex, and the rain thereby occasioned, should ever cease, when once it has commenced. Let us consider these two points separately.

Rain never begins to descend till the clouds have acquired a considerable degree of density. But your theory gives no account of how invisible vapour begins originally to condense into visible vapour, or cloud. If you say that condensation of invisible vapour begins in consequence of an upward vortex of air, the query then is, what originates this upward vortex of air?* According to my notions on the subject, the formation of clouds is chiefly occasioned by whatever reduces the temperature of the atmosphere; and this may be produced in a variety of ways, such as, 1st, By the reduction in the temperature which takes place during the transitions from day to night, and from summer to winter.† 2d, By the transportation of air by

* The up-moving column of air may take its rise either from acquiring more heat or more vapour than surrounding portions of the atmosphere; for it is known that vapour is only five-eighths the specific gravity of air.

† This cannot be the cause—for we have in this climate at all seasons numerous instances of entirely clear nights succeeding days with many clouds. No phenome-

means of aerial currents, from a warm towards a comparatively cold latitude or locality.* 3d, By the elevation of atmospheric currents in surmounting hills and elevated lands.† And also, as I hypothetically conceive, (though I am very doubtful of the truth of this hypothesis,) by the slow ascension of the atmosphere in the warmest latitudes of the earth, during the rainy season, in order to supply upper currents then diverging from these latitudes towards the north and south.

These causes are assisted, 1st, By the gradual intermixture of different strata of air when the upper strata become colder and specifically heavier than those underneath, after making the necessary allowance for the reduction of temperature, and diminution in the specific gravity of the aerial strata, which results on ascending from the diminishing incumbent pressure.‡ And it does not matter, whether the superior warmth of the inferior strata be occasioned by clouds arresting the radiant heat passing downwards towards the surface of the ground during day, or passing upwards from that surface during night; or whether it be occasioned by the evolution of heat which attends the condensation of invisible vapour into clouds during the

non is more common than for clouds to begin to appear at 8 or 9, A. M., and increase till the hottest part of the day, and then gradually disappear after sunset. And in Jamaica, this occurs every day in the dry seasons, almost always producing rain in the interior of the island about one or two o'clock.

* If cloud is produced in the first way, it ought to be in contact with the ground. For it can only be chilled by contact. This undoubtedly sometimes occurs, and fog is the result. But I have constantly observed, that when a very warm, and even damp atmosphere begins to blow from the south, after a very cold spell of weather, when the ground and stones of our pavement are so cold as to condense upon them a portion of vapour from the air—none of those clouds called cumuli are ever formed—the reason I suppose to be that no up-moving columns can then be formed.

Neither is cloud formed by the change from summer to winter, for there is more rain in the spring than in the autumn.

† This is undoubtedly one cause of clouds; but unless the cloud is specifically lighter than the surrounding air, how are these currents surmounting hills produced?

‡ If cold air comes down from a height sufficient to double its density at the surface of the earth, its temperature would be increased about 90 degrees, and it would be capable of containing about eight times as much vapour as it contained before it commenced its descent, even if it had been saturated; and the more it mingled with air in descending, the dryer it would make it—all which is known by experiment. And if heated air goes up, it is also known by experiment that it will condense more than one-half its vapour by the cold due to diminished pressure, before it reaches sixty hundred yards high; and that too without mingling with the air on the outside of the ascending column. It is also known by experiment that the vapour thus condensed, if the dew point is at 70° Fahr., (about a mean in our summer at Philadelphia) would give out as much caloric of elasticity into the air, where the cloud was formed, as would be given out by burning upwards of twenty thousand tons of anthracite coal on each square mile over which the cloud extends. And this would expand the air between five and six thousand cubic feet for every cubic foot of water generated in the cloud, after making the allowance for the diminished volume due to the condensation of the vapour itself. There fell in twenty-two hours at Ardeche, in France, thirty-one inches of rain, and it may easily be calculated that the caloric of elasticity given out during this time was sufficient to heat the whole atmosphere over the region where the rain fell to the above depth, 280° Fahr., provided no allowance is made for increased specific caloric of the air at great heights. The explanation of this astonishing phenomenon is too plain, according to my doctrine, to need any elucidation, except the simple statement that a cold of about 90° is generated in every portion of air which rises high enough to become of half the density which it had at the surface of the earth.

transportation of air from a warm to a comparatively cold locality, or any other cause.

The causes before mentioned are also assisted, 2d, By the more rapid diminution of the elasticity of aqueous vapour than that of air, as the temperature of both is reduced in ascending perpendicularly. This is unquestionably the chief cause of clouds forming at a considerable altitude in the atmosphere, rather than nearer the level of the sea. Indeed when the ocean to the north is warmer during the depth of winter than the incumbent atmosphere, and much warmer than the land, evaporation may, and frequently does, go on from the ocean to such an extent as to produce long continued rainy and cloudy weather, when the wind blows from a northerly and cold direction. Our snow storms from the north-east or north-west, and I apprehend your snow storms from the north-east, during the coldest season of the year, are produced in this manner. The moisture evaporated from the then warm surface of the ocean is condensed into clouds as it rises in the cold atmosphere. And this condensation is promoted by the farther reduction of temperature which it undergoes, in being transported over the cold winter surface of the land by aerial currents. In the climate in which I reside, the principal cause of the formation of clouds undoubtedly is, the transportation of air from a warm towards a comparatively cold locality by means of aerial currents. But whatever causes clouds to begin to form, if continued, must increase their density until rain is produced.

Again, if clouds and rain be produced only by an upward vortex of air, (supplied by converging currents below the clouds, and disposed of by diverging currents above them) which, according to your theory, has the power of perpetuating itself; when once begun, it should become a sort of perpetual motion, that could not by any possibility come to an end. But instead of this being the case, we find that all rains terminate.*

2d, If you state that upward vortices must be occasioned during day, by the atmosphere nearest the surface of the ground becoming then much more heated than the aerial strata above, the following and similar objections present themselves; 1st. How does more rain fall during night than during day? 2d. How does it never rain in Egypt, where the wind blows almost incessantly from the north, that is, from a cold towards a comparatively warm climate, and from the sea towards the land? According to your theory, the cold saturated air from the Mediterranean should have an unusual tendency to rise in vortices as it became heated in passing over the heated sands of Egypt; and contrary to what is the fact, should there produce in-

* When a lofty cloud is once formed, it certainly has a self-continuing power; and accordingly, we find that many storms originating in the West Indies, have continued for many days and nights in succession, and traveled many thousand miles from the place of beginning; terminating, it is true, in one place, but continuing to rage with violence in another. But to infer that they could not, by any possibility, come to an end, if they are really generated in this way, is illogical; for there may be many causes tending to diminish and finally destroy their force.

The quantity of rain which comes down from a great height has a tendency, both by impulse and its cooling effect on the air below, to diminish and sometimes stop its upward motion, and in the case of the rains in Jamaica, in the middle of the day, they appear to invert the motion and produce a land breeze towards evening. And when the land breeze commences, the air over the middle of the island must come downwards, and then not only will the rain cease, but the cloud which was formed by the upward motion will disappear, as it comes under greater pressure—as is demonstrated by experiment. Other means of terminating storms will be explained in a subsequent paper on the Moray floods.

cessant rain.* 3d. In like manner, how does it happen that at Marseilles, during the depth of winter, when the wind shifts from the north, and begins to blow from the south, that is, blows from the Mediterranean, and from a warm towards a comparatively cold land surface, clouds should rapidly begin to form and increase in density till rain begins to fall. The surface of the land being then so much colder than the incumbent atmosphere brought by a southerly wind from the Mediterranean, cannot give rise to an upward vortex upon any principle that I can conceive; but on the contrary, by communicating its coldness to the incumbent atmosphere, and thereby increasing its specific gravity, should rather counteract any tendency to an upward vortex of air.† In like manner, in the United States of

* This objection seems to be founded on an illogical deduction from my doctrine, that because all rains and snows and hails are produced by an up-moving current of air, therefore all up-moving currents of air must produce rains, hails, or snows. This does not follow: for if any one will take the trouble to look how cumuli are formed in a summer day, he will see them sometimes swelling up to a great height, and then, not yet having got dense enough to rain, their tops will be swept off by an upper current, moving in a different direction from themselves, or with a different velocity; and they will thus become spread out along the heavens, and their up-moving power destroyed. Now when the north wind blows in Egypt, the current below is almost diametrically opposite to what is known to be the direction of the current above in that latitude.

Besides, the current above contains all the caloric of elasticity which was given out to it, during the great condensation of the vapour which produces the mighty rains as it passes over the mountains in Abyssinia: so that it will contain very much more caloric to the pound than even the hot air on the surface of the ground in Egypt; and therefore when the up-moving currents over that country rise to the height of this upper current which is flowing off towards the north, they will enter a medium of less specific gravity than themselves, and on that account they will cease to rise.

Besides, I have long observed that if the dew point is more than 20° below the temperature of the air, cumuli hardly form, though the day is entirely clear, and up-moving columns forming as usual. This circumstance is easily understood, when it is known, as it is by experiment, that these columns cool about one degree and a third for every hundred yards that they ascend, whilst the strata of the atmosphere itself are only one degree colder for every hundred yards high. From these two facts it follows, that though the columns start upwards by their specific levity from greater heat near the ground, they are constantly, in their ascent, approximating nearer and nearer to a state of equilibrium with the surrounding air at their own elevation, and finally must cease to rise, unless they reach the point where cloud begins to form, and then as the law of cooling is changed to about two degrees for three hundred yards, the upward motion will be continued, unless hindered by some of the causes mentioned above.

† The effect here, I think, is put for the cause, and if so, the whole difficulty vanishes. The blowing of the south wind at Marseilles is not the cause of the formation of cloud, but the formation of cloud is the cause of the south wind. Now this south wind will bring with it a high dew point, and of course a light air, well calculated to run in under the base of a cloud already formed, and from the high *steam power* which it contains, calculated to increase its power of upward motion.

It is asserted that clouds begin to form after the south wind begins to blow: but if it should be discovered hereafter that the clouds begin to form first, the whole phenomenon is explained, and another strong link is added to the chain of evidence which is already formed in favour of the *law of storms* for which I contend. Now I have known many instances of long continued rains in the north, while there was a constant south wind, or rather west of south, in consequence of oblique forces operating generally to produce that effect in this latitude; and I never yet heard of a great rain in the western part of New York, without a southern wind at Philadelphia. And it will be very readily seen, that any air, however cold, if it is near the borders of a lofty cloud, will run in under that cloud, and be forced to ascend, when it comes under, if

America, where you reside, when the wind, during the depth of winter, blows from an easterly direction, that is, from the Atlantic, and a then warmer climate, clouds begin rapidly to form and rain follows, in consequence of the reduction of temperature which the comparatively warm atmosphere from the Atlantic undergoes in being transported over the then cold surface of the land.* But no upward vortices of air could be thereby generated, so as to account for the formation of clouds and rain agreeably to your theory. On the contrary, during the depth of winter, from Christmas till the end of February, when the prevalent wind in the United States is from the west or north-west, that is, from a cold towards a comparatively warm climate, upward vortices of air, and clouds, and rain, agreeably to your theory, ought to be produced; whereas, clear, dry, frosty weather is then the invariable concomitant of such a wind. Similar observations are applicable to the climate in which I reside, and in all others in temperate and cold latitudes. The most rainy winds are those which blow from a warm towards a comparatively cold climate; and the driest winds are those which blow from a cold towards a comparatively warm climate. But the former, viz. the rainy winds, can never originate an ascension of the undermost atmospheric strata; whereas, the latter, upon the principle of monsoons, and sea and land breezes, must always produce that tendency in a greater or less degree.

3d. In certain great rains, mentioned in your reports, extending simultaneously over a surface of many hundred miles in diameter, the wind at the surface of the earth, over the whole extensive tract of country where the rain fell, is said to have been blowing with great, or considerable, force, towards the centre of where the rain was falling; that there it fell in greatest quantity; and there, and there only, so far as I understood your report, the upward vortex of air existed. Now I am at a loss to know how any rain should have fallen, agreeably to your theory, beyond the boundaries of your supposed upward vortex of air. If clouds and rain are produced only by an upward vortex of air, how did it happen, on these occasions, to rain simultaneously for several hundred miles east, west, north and south, of the supposed upward vortex?†

a cloud has indeed the specific gravity which I assign to it: so that although a warm south wind blowing over a cold surface of land may be unsuited to originate an upward motion of air, yet it is well calculated to continue that upward motion after it has originated.

* The whole doctrine of our north-east storms appears to be entirely misunderstood. During their entire progress from the West Indies, in which they frequently originate, to Maine, the wind does not blow from a warmer to a colder climate, but the reverse. When the storm is yet in the West Indies, the wind is blowing from the N.; and when it reaches South Carolina, the wind in North Carolina and Virginia is from the N. E., and when it reaches Virginia, it is blowing in Pennsylvania and New York and Massachusetts from the N. E., and in Ohio from the N. W.; and in the northern borders of the storm, the wind is most violent from the north, and the quantity of snow is the greatest, as far as ascertained. See Jour. Frank. Inst. for Sept. 1837.) Moreover, whenever these storms pass Philadelphia, and are raging in the north-eastern states, the wind invariably changes to some western point, sometimes to the north of west, and sometimes to the south of west. It is true, that on the southern borders of these storms, the wind, at the same time, is blowing from some southern direction, and no doubt contributes much to the violence of the storm, from the quantity of steam it brings to the focus of action.

† Here again the doctrine taught by me appears to have been entirely misunderstood or overlooked.

The doctrine I have taught in all my essays is, that as soon as the air around a

4th. If your theory supposes that an upward vortex of air exists over the whole extent of surface where clouds are forming, or rain falling, the clouds, when viewed from the surface of the ground underneath, should always be stationary, though the wind be blowing underneath with great velocity, and in one determinate direction. Now in this country, (and I suppose it must also be the case in America,) when the wind blows with great or considerable velocity in one determinate direction, and clouds are forming or rain falling, the clouds are always moving in the same direction, and as nearly as can be estimated, with the same velocity as the air near the surface of the ground. Indeed, I have never, in a single instance, observed clouds remaining stationary during a very heavy rain, when the wind underneath was blowing strongly. Besides, the edges of clouds are frequently of such a ragged and marked character, and retain the same distinctive configuration for such a length of time, that if there was any rapid upward vortex of air underneath, such as is stated to be the case in your reports, the upward movement of the edges of the cloud would have been long since observed, and universally admitted; whereas, though horizontal movements of clouds during rain are constantly observed when there is any wind, an upward movement from underneath never has been noticed, and is not visible, so far as I am aware.*

5th. If I recollect right, you mention in one of your reports, that the heat communicated to the incumbent atmosphere by some very limited combustion underneath, gave rise to an upward aerial vortex which occasioned a local thunderstorm accompanied with heavy rain. I am inclined to think that if such a limited cause of increased aerial temperature produced the

cloud comes in under its base, it is under less pressure, and begins to ascend, not, of course, perpendicularly, but obliquely. It is only in the centre where the motion can be perpendicular; and so far from the greatest quantity of rain falling always in the centre of the storm, it sometimes happens that the perpendicular velocity of the air is so great, that the drops of rain are not permitted to fall there, but are carried up to a great height, and then spread outwards towards the borders of the storm, and fall there where the upward motion is not sufficient to overcome gravity. And if they should be carried high enough to freeze, they will fall in *hail*.

* In our great north-east storms, when they approach Philadelphia from the south-west within three or four hundred miles, the wind begins to blow from the N. E., and at the same time the top of the cloud from the storm generally makes its appearance, coming from the S. W.; and those two currents in opposite directions, continue for several hours before many clouds form below—and even when they do begin to form below, by the gradual sloping of the air upwards, the upper clouds are still seen through the openings, coming and thickening from the S. W.

It is true, indeed, when the storm of rain or snow comes on, the upper clouds are concealed entirely from view, and the lower clouds, being in the under current, are seen moving in the same direction with the wind.

Moreover, in violent summer thunder showers, which are sometimes only ten or twelve miles wide, I have frequently seen the clouds in the lower part move with great rapidity towards the centre of the cloud from all sides, and before I knew of the upward motion of the air in the middle, I have stood looking on with amazement, at not seeing them overlap, but seem to lose themselves in the centre, and others succeed in their turn. But when I calculated the effect produced by the evolution of the caloric of elasticity which is given out during the formation of cloud, and found that the volume of air in which the cloud was formed would be increased about six times as much by receiving this caloric, as it would be diminished by the condensation of the vapour into water, the mystery was immediately explained. And I think the reader will find, that this single principle will leave but few mysteries in meteorology, except the luminous meteors, unexplained.

thunderstorm in the case referred to, there would be an almost constant upward aerial vortex, accompanied with thunder and rain, over every large city. London, including its suburbs, extends about twelve miles in length by eight in breadth, and contains a population of about 1,800,000. In calm weather, particularly during winter, the increase of temperature communicated to the atmosphere by the combustion of fuel and animal respiration over the central portions of such a large city, cannot be less than eight or ten degrees beyond that of the atmosphere in the surrounding country. But instead of an excess of rain falling over London, the annual amount of rain there is only 22.2 inches, which is less than in almost any other part of England, where observations have been made. The air in the central parts of Glasgow during calm weather, in winter, is usually six or eight degrees warmer than in the surrounding country. Now, if this excess of atmospheric temperature occasioned an upward aerial vortex so as to produce clouds and rain, as should be the case if your theory were correct, the amount of rain that falls at Glasgow should be unusually great. But instead of this being the case, the annual amount of rain collected in the rain gauge kept at the M'Farlane Observatory, College Garden, when averaged for upwards of thirty years, was only about 22 inches; whereas the annual amount of rain collected in every one of the rain gauges kept within a limited number of miles of the city, was considerably greater. The circumstance of the amount of rain collected in the rain gauge kept at the M'Farlane Observatory being so much smaller every year than what was collected in any other rain gauge in the surrounding neighbourhood, attracted so much attention, that a committee of skilful mechanics and mathematicians were appointed to examine it. And they, after minute examination, reported that its construction and condition was in every respect accurate and perfect.*

6th. In one passage of the documents sent me, clouds, so far as I recollect, are stated to have been observed eleven miles high; and in another passage, fourteen miles high. No observations ever made in Europe, that I am aware of, have afforded evidence that clouds, even of the cirous kind, exist in the atmosphere above the elevation of 25,000, or 30,000 feet, at most.

* I do not recollect that I ever said, in any of my writings, that the heat communicated to the incumbent atmosphere by a very limited combustion, occasioned, by the upward motion produced in the air, a local thunderstorm, accompanied with heavy rain. But as it is my belief that great fires under favourable circumstances, may produce rains, I may have said something like it. But as this is a mere matter of opinion, and as it can only be decided by experiment, which I hope soon to try, I forbear to dwell on this point. I am, however, grossly misinformed if it does not rain much more frequently in and about large manufacturing cities in Europe, especially in Great Britain, than in other parts. It does not follow however, from this, that there will be more rain in the city itself than in the suburbs or the adjacent country; for the air is seldom so still that the column of cloud which might be formed over the city by the up-moving column of air, would remain so perpendicularly over the place of its formation, as to rain down on the city itself, as much as it will in the suburbs and neighbouring regions; and as the wind prevails from the west in the British isles, it is likely that more rain would fall on the east side of these great manufacturing towns than on the west. In accordance with this theoretical deduction, my friend, Mr. T. Sully, on his return from Europe, told me, that in comparing notes with Mr. Leslie, he found that Mr. Leslie had many more favourable days for painting in the west part of London, than Mr. Sully had, who was more eastern, on account of the thick weather and misty rain, which prevailed more where Mr. Sully lived. (More observations on this point are much wanted.)

7th. According to your theory, barometric fluctuations are occasioned exclusively by the same cause that produces clouds and rain, and which you say is an upward vortex of air, produced and maintained by heat evolved during the condensation of invisible vapour into clouds. Now when it is considered that the amount of rain which falls in a given time, and the amount of heat evolved during its conversion from invisible vapour into clouds, decreases from the equator to the poles, your hypothesis cannot be reconciled with the fact, that the range and fluctuations of the barometer, instead of decreasing, (as would be the case if your hypothesis were correct,) rapidly increases from the equator to about the 60th parallel of latitude, and again decreases from the 60th parallel as we advance towards higher latitudes. That this is the case, is evident from the following table:*

		Mean annual range of the barometer.
Quito,	S. lat. 0° 13	about 1 line.
Peru,		$\frac{1}{3}$ of an inch.
Calcutta,	N. lat. 22° 35	$\frac{1}{2}$ an inch.
Kathmander,	lat. 27° 30	.85 an inch.
Capital of Japan,	lat. 32° 43	.85 an inch.
Paris,	lat. 48° 50	$1\frac{1}{4}$ inches.
Great Britain, averaged		2 inches.
Petersburg,	lat. 59° 56	$2\frac{1}{4}$ inches.
Melville Island,	lat. 74° 30	1.86 do.

* According to my theory, undoubtedly the great barometric fluctuations are produced solely by the caloric of elasticity evolved by the condensation of vapour in storms.

I have made the calculation how much the barometer ought to fall under a cloud of a given height, with a given dew point, that is, with a given steam power in the air, and as this calculation is made on acknowledged scientific principles, it must stand, unless the principles themselves fall. The objections leave this fundamental principle unimpeached. No notice has been taken of it.

It is true indeed, that my "doctrine cannot be reconciled with the fact, that the range of the barometric fluctuations rapidly increases from the equator to about the 60th parallel of latitude." And if this were really a fact, it would be fatal to my doctrine, so far as the barometer is concerned, and then I would have to abandon the whole ground. But the fact is not so. If the reader will turn to Col. Reid's late work on hurricanes, he will find, at page 59, that the barometer fell at Porto Rico to 28 inches, on the passage of a hurricane, and rose 1.17 inches in an hour and a half. (See January number of this Journal.) And at page 269, the barometer fell in the Bay of Bengal, in a tremendous hurricane, to 27.80—having stood at 29.70 at the beginning of the storm. And at page 271, the mercury sunk out of sight below 26.50, having stood three hours before above 29 inches. This was at the mouth of the Hoogly—while at Calcutta, about one hundred miles off, the barometer fell only three-quarters of an inch.

Now, as these great fluctuations occur in these latitudes only when a great hurricane occurs, and are known to accompany the hurricane in its progress, and are great in proportion to the violence of the storm, it seems almost certain that the cause of the storm is the cause of the fluctuation, unless they are related to each other, as cause and effect.

Indeed, if it is a fact (and nothing is better established) that the barometer does stand low in the middle of these great hurricanes, all the other phenomena connected with them are mere corollaries. The wind will blow inwards with a velocity proportionate to the square root of the depression of the barometer; it will rise in the central parts of the storm in a similar ratio, that is, with the velocity of about 240 feet per second for a depression of one inch, without making any allowance for the rise of the barometer in an annulus all round the storm, in consequence of the rapid efflux of air on all sides in the upper part of the cloud; and even the very quantity of vapour con-

There is no doubt that such a thing as upward vortices of air, and gradual ascensions of large tracts of atmosphere supplied from underneath, by aerial currents near the surface of the ground, are constantly and simultaneously occurring on an immense number of different parts of the earth's surface. Whirlwinds afford examples of upward vortices of small extent. Sea and land breezes, monsoons, and local as well as more extended winds, blowing from a cold towards a comparatively warm climate or locality, can only be accounted for by supposing that opposite aerial currents simultaneously exist in the upper and lower halves of the atmosphere. The air, in such circumstances, must be gradually descending over the cold locality to supply the lower current; and ascending over the warm locality, to supply the upper current. But some of the facts which I have mentioned, such as the case of the north wind in Egypt, sea and land breezes in intertropical climates during the dry season, and the general fact of all winds that blow from a cold towards a warmer locality, being comparatively dry winds, show that the upward ascension of air is not the only cause of rain.* And judging from the facts mentioned, and others of a similar kind, I am very doubtful if an upward vortex of air, either upon a limited or an extend-

densed per second may be calculated, if the dew point and depression of the barometer are given; and it is found adequate to produce those mighty floods of rain which are known to fall in these storms. The quantity of rain which sometimes falls in one of these hurricanes, over a limited space, is certainly as much as ten inches; in which sufficient caloric of elasticity is given out to heat the whole of the air over this region, from the top of the cloud down to the surface of the earth, more than one hundred degrees. But when it is considered that every portion of air which rises from the surface of the earth to that height, undergoes a refrigerating process of more than one hundred degrees, from diminished pressure, and that it would actually become colder to that amount, if it were not for the caloric of elasticity given out in the condensation of the vapour, which prevents it from cooling more than about half this quantity, as I have demonstrated by experiment, it will no longer be a mystery how so great a quantity of vapour is condensed by cold, in air which is at the same moment receiving such an immense amount of caloric.

* This conclusion does not follow from the premises. It would be logical to say, these facts show that the upward motion of air is not always the cause of rain; and such is undoubtedly the fact. I have myself seen hundreds of up-moving columns forming large cumuli without producing rain, but it certainly does not follow from that fact, that cumuli are ever formed without up-moving columns.

Flat low islands in the West Indies have sea breezes, and of course up-moving columns in the central parts of them, but there being no mountains to prevent these columns from being swept off, out of the perpendicular, before they rise high enough to form dense and deep clouds, rain is frequently not the result. Now when the wind blows from the north-west at Philadelphia, though up-moving columns may be formed in great numbers, as they no doubt are, yet they do not rise very high till they enter a current above, moving in a different direction, and though clouds may begin to be formed before they enter that current, yet when they do enter it, the columns will be broken and their force destroyed.

On the contrary, whenever the lower current of the air is moving in the same direction with the upper, and with the same velocity, which can only be the case in this latitude, when the wind is from some southern or south-western direction, then the columns can rise to a great height without being broken, and this is one reason why a southerly wind is favourable for rain. These observations apply exclusively to the generation of a rain cloud, and not to the phenomena which occur after a great rain cloud is generated. After that is done, the cloud has a self-sustaining power, and frequently continues as violent in the night as in the day, and if even it should be found to discharge more rain in the night than in the day, as asserted above, it would not be inconsistent with my theory.

ed scale, (except upon the principle of intermixture,* and also when the atmospheric current rises in surmounting hills,) is ever, in any instance, a cause of the formation of clouds, or of the descent of rain, *in temperate or cold latitudes.* And from comparing the extreme smallness of the fluctua-

* The doctrine of the intermixture of airs at different temperatures producing rains will not bear the test of examination. I demonstrated, in the very essays here criticised, as the reader will see in the Journal of the Franklin Institute for 1836, that if the two halves of the atmosphere, the upper and lower, one at the temperature of 80° and the other zero, both saturated with vapour, should be mingled together by magic, (for they cannot be mingled by any causes in nature) that the caloric of elasticity given out in one of our great thunder storms, (5.1 inches of rain) if communicated to the mass of air so mingled, would leave the whole about 20° hotter than the hottest half before the mixture. But why suppose a mixture in case of an upward motion of air, as it is here supposed, if it goes up to where the barometer would stand 15 inches, it would cool without mixture at least 85°, as I have demonstrated by experiment, if no allowance is made for the caloric of elasticity given out by the condensing vapour.

And if any one will carefully watch a cumulus cloud while forming into a nimbus, if he is properly situated for seeing the whole phenomena, he will observe a wonderful stillness in the borders of the cloud, while it is puffing out at the top, as it it were "blown into below by a pair of great bellows."

He will see the lower part of the cloud much agitated, and flocculi darting in from the borders towards the centre, and finally, small clumps of clouds suddenly forming some distance below the black base, and darting up into that base, "like sky rockets;" in short, the whole phenomena corresponding precisely with the supposition of an upward motion of the air, both below and above the base of the cloud. If this cloud is formed from the mixture of airs of different temperature, which I have shown could not be on other grounds, I think it is certain that it could not assume the present form. If it were formed of strata of air, one over the other, and moving in different directions, so as to mingle between them and produce cloud, then the cloud would have a flat appearance, and could not possibly rise into a pyramid of six or eight miles in height, in a very short space of time, in regular form.

If it was formed either by an up-moving column of warm air, or by a down-moving column of cold air, mingling with the air through which it passed, then would the cloud appear something in the form of a hollow cylinder, for the central parts of the ascending or descending column could not mingle with the surrounding air. Now the central parts of the cloud seem to be much the densest, if we can form any judgment from the blackness of the base, just as it should be on my principle, but not at all on the Huttonian. It will not surely be contended that air can be mingled to any extent sufficient to produce large clouds by different currents meeting each other on the same horizontal level, and even if it should, it could not be imagined how a cloud in the shape of a sugar loaf could be formed on this principle, with a flat base, always just about as many hundred yards high as the temperature of the air is above the dew point in degrees of Fahr. at the time the cloud is forming, which exactly corresponds with the height of the base, on the supposition that the air does move up from the surface of the earth into the base of the cloud. Besides, if it should be found, as is highly probable, that the upper portions of the atmosphere always contain more caloric to the pound than the lower, from the caloric given out there by the vapour condensing into cloud, the doctrine of mixture forming cloud, would have to be given up on this ground alone.

I have now attempted to answer all the objections which have been brought against my theory by a gentleman of highly cultivated and acute mind, one who has himself written one of the best treatises on meteorology extant, and also a very late work on Unexplained Phenomena, which I do not hesitate to say, manifests great originality and power of thought, though I am not yet prepared to subscribe to all his views.

If I have not been entirely successful in answering, to the satisfaction of the candid reader, all the objections, I think it will be but fair to set down the failure, not to the weakness of the theory, but to the want of skill in the advocate. Indeed I doubt not that the intelligent reader who has made himself thoroughly acquainted

tions and range of the barometer in intertropical climates, where the rains are heaviest, with its great fluctuations and range in temperate latitudes, where the amount of rain is comparatively very small, it is obvious, that if clouds and rain be occasioned by upward vortices of air, barometric fluctuations must be either wholly occasioned, or at all events much assisted, by some other cause.

The preceding remarks are penned in a spirit of perfect candour and impartiality, and I hope you will receive them in a similar spirit. They will point out the objections to your theory which most readily suggest themselves to the mind of an impartial reader. If your theory be true, you will be thereby enabled to know what points require further elucidation, and also what objections ought to have been anticipated and answered —an object, which, in advancing a new theory that has to contend with pre-existing opinions, ought never to be lost sight of.

I am, dear sir, your most ob't. servant,

GRAHAM HUTCHISON.

Glasgow, Scotland, 11th October, 1838.

with the theory, will see that many points could be much more clearly elucidated. If, indeed, I had not been able to answer any one of the objections, the theory might still be true, for the foundation of it is not shaken by any one of them.

Suppose, for instance, I had not been able to show that the barometer does actually fall in the torrid zone, on the passage of a hurricane, it would not prove my theory untrue, because it might have so happened that no barometrical observations had ever been recorded in the midst of the storm. If, indeed, it had been established by well authenticated observations that the barometer does not fall in the middle of a hurricane, I would have to acknowledge it to be the *experimentum crucis* to disprove my theory. But this fact never will be established. For so long as the laws of gravity remain unchanged, the barometer will fall when pressed by less incumbent weight, and as long as the relation between the caloric of elasticity of vapour and the specific caloric of atmospheric air, remains unchanged, this caloric will expand the air in contact with the condensing vapour, in the formation of cloud, upwards of five thousand cubic feet for every cubic foot of water thus generated, after making allowance for the condensation of the vapour itself—as I have demonstrated by experiment, independent of the chemical principles on which the calculation was originally made. (See Phil. Saturday Courier, of 18th March, 1837.)

I thank the author of these able strictures for the candid manner in which they were made. If my theory is true, it will bear the test of the severest examination, which I invoke from other minds of equal acuteness. If it is false, no one is more interested than myself that it should be speedily refuted. But in this inquiring age, when men will think for themselves, neither the hasty and unpremeditated opinion of one of the most distinguished philosophers of Europe, that Mr. Espy's theory could not be true, for it requires the barometer to stand high in the middle of hurricanes, nor the deliberate and long cherished opinion of a distinguished chemist of America, of whose discoveries his country is justly proud, that Mr. Espy's theory is suicidal, requiring the air to be colder to condense the vapour, and at the same time warmer, to produce an ascending motion, will satisfy the mind of any one who chooses to investigate the subject thoroughly; for he will perceive that neither of these conclusions follows from the doctrine which I teach.

The foundation on which I build must be sapped, before the superstructure can be overthrown. Let any one try the following experiment, and he will be able to tell whether my corner stone is firmly laid or not. Try how much the temperature of both dry air and air saturated with aqueous vapour is reduced in temperature by a given diminution of pressure, and if he finds, at ordinary summer temperatures, the moist air reduced only about one half that of dry air, as I have found it, he will, by careful examination, be able to perceive, that all the doctrines which I teach on this subject follow as corollaries from this single fact, in connexion with other facts heretofore established.

JAMES P. ESPY.

Franklin Institute.

Annual Meeting.

The Annual Meeting was held at the Hall of the Institute, on Thursday evening, January, 18th, 1839.

James Ronaldson, Esqr., President, in the Chair;

Isaac B. Garrigues, Esqr., Recording Secretary.

The minutes of the last Quarterly Meeting were read and approved.

Donations were received from the Royal Geographical Society of London; the Royal Irish Academy of Dublin; Samuel M. Stewart, Wm. Boardman, Jr., and Abraham Miller, Esqrs., of Philadelphia; Capt. Gwyn, United States Navy, and Hon. John Fine, per J. J. Barclay, Esqr., Messrs. Baughman and Geauteau, of Pennsylvania, and Mr. N. Scholfield.

The Actuary laid on the tables the periodicals received in exchange for the Journal of the Institute, during the past quarter.

The annual report of the Board of Managers was read and accepted, and referred to the Committee on Publications.

The Treasurer presented his report of the funds for the last quarter, and also a statement for the year ending December 31st, 1838—which were read and accepted.

The Committee on Publications presented their report on the operations of the Journal of the Institute, for the past year, which was read and accepted.

Mr. Edwin Greble, from the Committee of Tellers of the annual election of Officers and Managers of the Institute, for the ensuing year, (appointed at the preparatory meeting, this day,) presented their report of the result of the election, when the President declared the following as duly elected:

James Ronaldson, President.

Isaiah Lukens, } Vice Presidents.
Thomas Fletcher, }

Isaac B. Garrigues, Recording Secretary.

Isaac Hays, M. D., Corresponding Secretary.

Frederick Fraley, Treasurer.

Managers.

Samuel V. Merrick,	John C. Cresson,
Abraham Miller,	Andrew M. Eastwick,
William H. Keating,	Isaac P. Morris,
John Struthers,	Charles B. Trego,
Matthias W. Baldwin,	Henry Troth,
Alex. Dallas Bache,	John S. Warner,
J. Henry Bulkley,	William H. Carr,
Alexander Ferguson,	Robert M. Patterson,
John Agnew,	Henry D. Rogers,
John Wiegand,	John Gilder,
Alexander M'Clurg,	Ambrose W. Thompson,
Samuel Hufty,	George Taber.

(Extract from the minutes.)

James Ronaldson, *President.*

Isaac B. Garrigues, *Rec. Secr'y.*

Fifteenth Annual Report of the Board of Managers of the Franklin Institute, of the State of Pennsylvania, for the promotion of the Mechanic Arts.

In conformity with the requisitions of the constitution, the Board of Managers present to the Institute their report of the various departments of business which have claimed their attention during the past year.

As one of the leading objects of the Institute, from its commencement, was the acquisition of a good Library, this subject has necessarily received the due attention of the Board.

During the past year there has been added to the Library 316 volumes. Of these, 142 were by purchase, 48 by exchanges, and 126 by donations. The Library now contains 2,200 volumes, embracing the most valuable works in all the various departments of science and the arts; and has cost the Institute, since its establishment, the sum of $5,562.23: of this amount $265.17 has been expended during the past year.

The Library is divided into two classes; the first comprising such works as, from their rarity, value or extent, ought not to be lent out; and also all unbound periodicals, and such text books as ought constantly to be found in a library of reference.

The second class includes all other books intended for circulation among the members.

The extent to which the library is used, affords the most gratifying evidence of its utility.

The Journal of the Institute merits a more extensive patronage. Many of its leading articles have been re-published in Europe; and with such commendations as are highly flattering, both to the Institute and the cause of American science. It is to the Journal that we are indebted for the valuable exchanges which are spread upon the tables of our reading room.

The success attending the lectures of the Institute, is gratifying in the highest degree, and is the best evidence the Board could desire, that the lecturers are eminently qualified for the duties they have assumed.

The only cause for regret is, that the lecture room does not afford sufficient accommodation for all who desire to receive instruction. In addition to the regular tickets furnished to the members, there have been sold 295 minor's tickets, 75 ladies' tickets, and 19 tickets to strangers. Dr. J. K. Mitchell continues to fill the chair of chemistry, Jno. C. Cresson, Esqr., that of natural philosophy, and James C. Booth, Esqr., that of Technology.

The departments of architectural and miscellaneous drawing, are under the superintendence of Mr. W. Mason, and Mr. Jno. M'Clure. The number of pupils is 97. Large as this number is, it is limited only by want of more liberal accommodations. During the past year there have been several valuable additions made to the cabinet of models; but the Board have been prevented, by want of a suitable room, so to arrange and exhibit the models as to do justice to the Institute.

The arrangement of the cabinet of minerals is completed; it occupies an entire room, and in variety and extent is but little inferior to any other cabinet in the city. Arrangements have been made for the preparation of a catalogue of all it contains.

It is a source of satisfaction to the Board, to witness the interest which is taken in the reading room; it is the place in which a large proportion of the members daily spend a profitable hour. There are received there thirty-

four newspapers, and thirty-eight periodicals; of the periodicals, nineteen are English, seven French, and twelve American. The Journal of the Institute affords a sure guarantee that these sources of improvement will steadily increase.

The exhibition of American manufactures, held by the Institute, in November last, exceeded the most sanguine expectations of the Board. The articles, with very few exceptions, were not prepared for special exhibition; beautiful as the specimens exhibited generally were, they are only to be regarded as fair samples of American skill, such as are to be found constantly in our warehouses and shops. In extent and variety they far exceeded any similar exhibition ever held in this country.

A detailed report of the exhibition is expected shortly from the committee to whom the subject is assigned, which will be duly submitted to the Institute.

The Board of Managers acknowledge their indebtedness to the members of the Institute, and to other gentlemen for their services in arranging the various specimens for exhibition. It will be gratifying to the Institute to learn that notwithstanding the immense concourse of visitors, nothing occurred at any time to disturb the company: the arrangements of the committees were wisely made, and conformed to with strict propriety.

The appropriation made by the legislature, to the Institute, for meteorological observations, was, until within the last six months, under the control of a joint committee, composed partly of members of the Institute, and partly of members of the American Philosophical Society. The committee thus constituted, were at a loss to determine to which body they were accountable. Finding themselves thus embarrassed, that portion of the committee appointed by the Philosophical Society, were discharged by that body, and the Board immediately appointed a standing committee on the subject of meteorology, and have charged them with the duty of carrying out the design of the legislature.

This committee have entered upon the prosecution of their duties with spirit: several reports of the results of their labors have been spread before the public through the Journal of the Institute.

The committee on science and the arts, have examined, during the past year, the merits of various projects and machines which have been submitted to them: upon fifteen they have reported in detail. These reports, unless otherwise ordered, have been published in the Journal.

Experience thus far proves the utility of this committee. It not unfrequently happens that the novice in science or arts is saved much fruitless toil and expense by their investigations.

The Board regret that they have been unable, as yet, to enter into any arrangements for the erection of a new hall. The embarrassments in which the commercial community has been so recently involved, preclude the hope that so desirable an object can be speedily attained. Until trade shall again flow on in its accustomed channels, and industry and successful enterprise shall seek investments for their rewards, the erection of a new hall must be postponed.

The Board, however, have the satisfaction to state that their property on Chesnut street is not at present a source of embarrassment to the Institute—the income from it is adequate to meet all the expenses.

Nothing further has been done towards the establishment of a School of Arts. It was the design of the Board to make an early and vigorous ap-

peal to the legislature for the necessary aid to establish such a school. In this design they were frustrated by the difficulties attending the organization of one of the legislative branches.

As these difficulties have terminated, it is earnestly recommended to our successors in the management of the Institute, as early as possible again to press this subject on the attention of the legislature.

During the past year there have been elected five hundred and ten new members, seventy have resigned, and five deceased. Jno. C. Hunter, Chas. Brown, Wm. Struthers, Jno. Reeves, Edward Henderson, E. A. Etting, Jno. F. McNabb, Geo. Wilmer, Wm. Wright, Jno. White, Thos. A. Biddle, Clement Biddle, Jr., and Wm. Harris, have become members for life.

In reviewing their labors, the Board of Managers feel that while they have been prevented, by obstacles totally beyond their control, from accomplishing all the desirable objects entrusted to their care, the main designs of the Institute have been steadily advancing.

In carrying out these designs, the Board have always found in the Actuary of the Institute, a prompt and efficient agent. During the suspension of specie payments, the former Board, in order to meet their engagements, authorized the issue of certificates of loan, bearing interest. Notwithstanding a portion of these loans was irredeemable until 1847, the Board have directed the Actuary to pay them off upon the presentation of the certificates. Of the whole amount issued, there remains yet unpaid, about $600. This balance the Actuary is prepared to meet on demand.

For the condition of the finances, the Institute is respectfully referred to the annual report of the Treasurer, which is herewith submitted.

It is now fifteen years since the Franklin Institute was numbered among the associations for the promotion of science and the arts. From an extremely limited number, with which its existence commenced, it now enrolls the names of 2,513 members. From the novel character of the institution, its founders had many prejudices and difficulties to encounter; they were destitute of that practical wisdom which experience in the management of similar institutions, could afford. There was nothing in our own country like it, unfolding to the comprehension of the unlearned practical man the various processes of his art. It would scarcely be justice to the founders of the Franklin Institute, to say that they were men of enlarged and liberal views, they were more, their plans were wisely laid and successfully prosecuted. Of this, the prosperity of the Institute, and its reputation both at home and abroad, are sufficient proofs. Nor have the benefits of the Institute been confined exclusively to the man of science and the artisan. Its lectures are now regarded, by many of our most worthy citizens, as indispensable to the education of their children. For the cause of education the Institute has effected much, and promises more. The youths who have been instructed, and those who are now receiving instruction, in our lecture room, have yet to exert their influence in the cause of education. The tastes for knowledge which shall be there induced *will* be gratified. Philadelphia now more than creditably sustains a number of lecturers on general literature and science, who a few years since could not have obtained an audience to encourage them. May not these popular evidences of intellectual taste and improvement, be regarded as some of the fruits of the Franklin Institute. For the manufacturer and mechanic, the Institute has unquestionably accomplished much; it has been steadily and securely elevating their professions to a level with those which were once regarded as

the exclusively learned; it has removed the prejudices which were once associated with the pursuit of mechanics, and taught this practical lesson, that moral and intellectual worth makes the man.

JOHN WIEGAND, *Chairman.*

WILLIAM HAMILTON, *Actuary.*
Philadelphia, Jan. 16th, 1839.

Minutes of the Board of Managers.

At a meeting of the Board of Managers, held at the Hall of the Institute, January 23d, 1839,

Mr. JOHN AGNEW was elected Chairman of the Board; and

Messrs. JOHN C. CRESSON, and HENRY TROTH, Curators for the ensuing year.

At a meeting of the Board, held February 20th, the Chairman nominated the Standing Committees agreeably to the By-Laws. On motion, Alfred Langdon Elwyn, M. D., was added to the Committee on the Library; Messrs. Jno. Agnew, John McClure, and Thomas S. Stewart to the Committee on the Cabinet of Models; Mr. James C. Booth to the Committee on the Cabinet of Minerals; Mr. John Agnew to the Committee on Premiums and Exhibitions; Professors Roswell Parke, Robert Hare, and John K. Mitchell to the Committee on Monthly Meetings; Messrs. Charles Thomas, Jacob Bennet, and William Kirk to the Committee on the Exchange; and Robley Dunglison, M. D., Messrs. James P. Espy, Charles N. Bancker, John K. Kane, Sears C. Walker, and Gouveneur Emerson, M. D. to the Committee on Meteorology; when the committees were appointed as follows:—

On the Library.

Henry Troth, *Chairman.*	J. Henry Bulkley,
Isaac Hays, M. D.,	Robert M. Patterson, M. D.,
Alex. Dallas Bache,	Ambrose W. Thompson,
Isaac P. Morris,	Alfred L. Elwyn, M. D.

On the Cabinet of Models.

Isaac P. Morris, *Chairman.*	John Gilder,
John Struthers,	George Taber,
Andrew M. Eastwick,	John Agnew,
Isaiah Lukens,	John McClure,
William H. Carr,	Thomas S. Stewart.

On the Cabinet of Minerals.

Charles B. Trego, *Chairman.*	Abraham Miller,
Isaiah Lukens,	Henry D. Rogers,
William H. Keating,	Thomas Fletcher,
Samuel Hufty,	James C. Booth,

On Publications.

Isaac Hays, M. D., *Chairman.*	Matthias W. Baldwin,
Alex. Dallas Bache,	John C. Cresson,
Samuel V. Merrick,	Robert M. Patterson, M. D.

On Premiums and Exhibitions.

John C. Cresson, *Chairman.*
William H. Keating,
Alexander Ferguson,
Thomas Fletcher,
Isaac B. Garrigues,
Alexander M'Clurg,
John S. Warner,
John Agnew.

On Instruction.

Alex. Dallas Bache, *Chairman.*
Frederick Fraley,
John Wiegand,
Isaac P. Morris,
Abraham Miller,
Charles B. Trego,
Henry Troth,
Henry D. Rogers.

On Monthly Meetings.

John C. Cresson, *Chairman.*
Andrew M. Eastwick,
Henry D. Rogers,
John S. Warner,
William H. Carr,
Roswell Parke,
George Taber.
Alex. Dallas Bache,
John Wiegand,
Robert M. Patterson, M. D.,
Robert Hare, M. D.,
J. Henry Bulkley,
John K. Mitchell, M. D.,

On the Exchange.

John S. Warner, *Chairman.*
John Struthers,
Andrew M. Eastwick,
Isaac B. Garrigues,
John Gilder,
Charles Thomas,
Jacob Bennet,
William Kirk.

On Finance.

William H. Keating, *Chairman.*
Samuel V. Merrick,
Alexander Ferguson.
Frederick Fraley,
Henry Troth.

On Meteorology.

Robley Dunglison, M. D.,
Charles N. Bancker,
Henry D. Rogers,
Robert M. Patterson, M. D.,
Gouveneur Emerson, M. D.
James P. Espy,
John K. Kane,
Sears C. Walker,
John C. Cresson.

Managers of the Sinking Fund.

Samuel V. Merrick, *Chairman.*
Frederick Fraley.
Alexander Ferguson,

Auditors.

Isaac B. Garrigues,
William H. Carr.

(Extract from the minutes.)

JOHN AGNEW, *Chairman.*

WILLIAM HAMILTON, *Actuary.*

COMMITTEE ON SCIENCE AND THE ARTS.

Report on William Jenks' Improved Fire Arms.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination an improvement in Fire Arms, invented by Mr. William Jenks, of Springfield, Massachusetts, REPORT:—

That the improvement consists of a piston or plunger, fitting in a chamber in the breech of the piece, which is drawn back by a lever and several pieces of metal, so as to permit the ball and charge of powder to be put into the chamber through an opening in the upper part of the breech. After which, the lever being depressed, the piston is forced forward by the above mentioned pieces of metal, which constitute, by their position, a species of toggle-joint. When the charge has thus been forced home, the joints are a little beyond a straight line, from the breech to the extreme point of action. It follows, as a necessary consequence, that the piston cannot be forced back by the discharge of the piece, and requires no fastening of any kind.

The Committee is of opinion that the invention of Mr. Jenks is a simple, safe and efficient improvement in the construction of fire arms, that it presents very little difference to the eye, from guns of the ordinary construction, and is, as far as they perceive, free from all the objections which usually accompany breech loading, and possesses all its advantages.

By order of the Committee.

William Hamilton, Actuary.

December 13, 1838.

Thomas Oliver's System of Cutting Garments.

To the Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania.

The Sub-Committee to whom was referred the consideration of Mr. Thomas Oliver's publication of an erroneous report purporting to emanate from the Committee on Science and the Arts of the Franklin Institute, REPORT:—

That at the request of Mr. Oliver, a sub-committee was appointed to examine his system of cutting garments, who made a report generally favourable to that system; a copy of which was furnished to Mr. Oliver. The present sub-committee find that on publishing that report, Mr. Oliver has added in the body of it the following paragraphs,—

"*This great desideratum the Committee think has never been attained by any other method of drafting.*"

"*Various systems of cutting have appeared within the last few years, all, or nearly all, of which have been examined by members of this Committee, but, without wishing to detract from the merits of any other system, not one so far has been found entirely to answer the purpose for which it was intended.*"

The following paragraph, viz. "The Committee believe that Mr. Oliver's system is calculated to obviate the difficulty under which tailors have laboured,"

Mr. Oliver has altered to read

The Committee believe that Mr. Oliver's system is *better* calculated to

obviate the difficulty under which tailors have laboured, *than any of the above named systems.*

Another paragraph, viz. "One member of this Committee has tested the system by cutting a number of coats by it, and does not hesitate to give it his unqualified approbation,"

He has changed to read

Several of the Committee have tested the system by cutting a number of coats by it, and *they do* not hesitate to give it *their* unqualified approbation.

By instructions from this Committee, the Actuary had an interview with Mr. Oliver, who acknowledged the alterations, and promised to make a public acknowledgment of the fact, but the Committee have since understood that he has left the city with an intention of going to Europe, without having complied with this engagement. This Committee, therefore, recommend that the above statement should be laid before the public, in justice to other persons interested in the case, and as an act of duty on the part of the Institute.

By order of the Committee.

William Hamilton, Actuary.

February 14*th*, 1839.

English Patents.

Specification of a patent granted to James Hellewell, *of the county of Lancaster, Dyer, for his invention of an improved process or manufacture, whereby the texture of cotton and certain other fabrics and materials, may be rendered impervious to water.* [Sealed 28th November, 1835.]

These improvements, in the process whereby the texture of cotton and certain other fabrics and materials may be rendered impervious to water, consist in steeping the fabric, intended to be made waterproof, in a peculiar solution, which has been previously prepared for the purpose, in vats or cisterns of any required dimensions and material, and which are to be situated in any convenient position, so as to carry on the process to the required extent, and in the most advantageous and convenient manner to the operator. It is generally known that the water-proof cloths which have been found superior to others, and which have been mostly adopted for the purposes of wearing apparel and other similar uses, are composed of two pieces of material cemented together with a preparation of caoutchouc, or other material, and thereby rendered totally impervious to air as well as water, which fabrics (usually called "double texture,") are exceedingly detrimental and repulsive to the action of natural perspiration, to obviate which defects my improvements are principally designed, and the expense of rendering manufactured articles perfectly water-proof is greatly reduced by their being of single texture only, and merely steeped or saturated in the solution hereafter described, which is found to make it repel the action of the water, and prevent its running through the fabric, and at the same time leaving the fibres of the cloth sufficiently open to allow the necessary passage of air.

I presume, as the principal feature of novelty and improvement is now understood, and the object of my invention sufficiently explained, a description of the ingredients and their relative quantities will only be needful to render my invention fully and most perfectly understood; and as by

experience I have found that dyers, and persons accustomed to use such like processes, in general mix their solutions with particular regard to the weight of the manufactured material to be steeped therein, and without any reference to its length or width, (which is always so much more variable than its weight) I shall describe my process in pursuit of the same plan, being most approved, and generally found the most correct. The mixture of ingredients I have hereafter described, will be found the best quantity in which to saturate fabrics to the weight of 1000 lbs. avoirdupoise. When the cisterns or vats have been previously disposed so as to contain the proper quantities of materials, mix in one large vessel (which may be subsequently divided) about 200 gallons of water with about 120 lbs. of common alum in its crystalized state, commonly called rock alum, and for the purpose of rapid dissolution, I prefer that the alum should be previously ground or pulverized; to this mixture add, in small quantities, about 80 lbs. of whiting (chalk cleared of impurities and ground in a mill.) It will now be found by this addition, a considerable effervescing action has taken place, and a chemical change has also been effected, whereby the sulphuric acid, of which the alum principally consists, is perfectly destroyed, and the alumina, which is the residuum I require, left entire; now the alumina being in a state of solution, and remaining with the water, the whiting and other unnecessary parts will precipitate and remain at the bottom of the vessel; when entirely cold, the liquor may be drawn off, leaving the impurities and sediment in the bottom of the vessel in which the preparation has been made, and in this state is ready for immediate use. The cloth or fabric intended to be saturated is now to be introduced into suitable vessels containing the above mentioned solution, and either allowed to remain, to be thoroughly steeped, or merely passed through the solution, as found most convenient, provided that the cloth is sufficiently saturated. I also wish it to be understood that I have found acetate of lead (sugar of lead) to have the same effect in destroying the sulphuric acid contained in the alum, but it is much more expensive, besides leaving a quantity of acetic acid in the solution, which will be found injurious to many colours, of which the fabrics may happen to have been dyed. The cloth is now to be taken to a vat or vessel containing a mixture of water with common yellow soap, allowing about 3 lbs. of soap to every 50 lbs. of cloth, and to be mixed with about 30 gallons of water, either more or less, as shall be found by the experience of the operative to have the desired effect; the soap may either be dissolved by boiling, or cut into pieces and boiling water poured on to it, and when it has cooled to about 100 degrees Fahrenheit, the cloth is to be passed quickly through the solution in the most convenient manner. This part of the process is for the purpose of strengthening the repellant qualities of the cloth, which have been subjected to previous saturation, and fastening the alumina, which has been taken up by the cloth during the former process, that is, preventing it from being washed out or destroyed. By way of cleansing the fabric, which is now rendered perfectly repellant and impervious to water, from any impurities, such as soap lees or other extraneous matter which it may have taken up during its passage through the processes above described, I now pass the same through cisterns of clear water, in any convenient manner, and after being dried the cloths are ready for use, some qualities of which may require to be finished or calendered in the usual manner. Although the principal object of this invention is intended to be used for such goods or materials as are manufactured from cotton, I wish it to be understood that I will not confine myself to that fabric alone,

as it must be evident that wool, silk, linen, or any other fibrous substance, may be subjected to similar processes with the same advantageous effect. Nor do I mean to confine my claim to the use of the precise quantities here specified, as they are mentioned merely for illustration, and are such as I have found to be most convenient and beneficial. Lond Journ. Arts & Sciences.

Specification of a Patent granted to Francis Moll, *of the county of Surrey, for his improvements in preserving certain vegetable substances from decay.* [Sealed 19th January, 1836.]

This invention is for impregnating timber with two products of coal tar, which the patentee denominates enpion and kreosot. These products are obtained in the following manner:—A quantity of coal tar is put into a still, and a gentle heat is applied, until a vapour comes over; which vapour is to be condensed in the ordinary manner. The distilling operation should be continued until the enpion has acquired about the same specific gravity as water.

This product, when in its pure state, the patentee informs us, is called by English as well as German chemists, "enpion;" and although it is not exactly in a pure state when obtained, as above described, it is of sufficient purity for the purposes to which it is to be applied by the patentee. The "enpion" obtained as above described, will be found, upon testing it with the proper tests, such as litmus paper, &c. to contain acids; these acids, however, may be got rid of by washing the enpion with lime or other alkaline water, or a quantity of dry lime may be mixed with the coal tar to neutralise the acid; and if water is distilled over with the enpion, the enpion will be found floating on the surface of the water, and may be drawn off.

The next product is obtained by raising the coal tar in the still to a very high temperature, when a further vapour will come over freely, leaving only the pitch in the vessel; this is also to be condensed in the same manner as the enpion, and is called by English as well as German chemists, "kreosot." This product may also be subjected to the action of lime water, to free it from any acids, if thought desirable. When these products are obtained, the patentee applies them to the timber in the following manner:—

A cast iron tank or chamber is to be constructed in any convenient manner, and the timber placed therein in such a manner that the vapour of the enpion and kreosot may have free access to all parts of it. The temperature of this chamber should be raised to about 90 or 100 degrees of Fahrenheit's thermometer, by steam pipes or any other convenient means.

Previous to allowing the vapour to enter, it is requisite that this operation should be performed so that the enpion may be allowed to flow into the chamber in a state of vapour and fill it; and it is also required to expel any degree of moisture from the timber.

After the chamber has been heated a sufficient time, the water that has been expelled from the timber by the heat, should be drawn off, and the vapour of the enpion should then be allowed to enter and diffuse itself throughout the chamber, when it will impregnate the timber. When the timber has been sufficiently impregnated with enpion, the enpion should be drawn off and the vapour of kreosot must then be allowed to enter from the still; and the kreosot will be found to have such an affinity for the enpion, that it will speedily impregnate the whole of the timber wherever the enpion has

gone, the enpion acting as a guide, and the kreosot itself being the antiseptic. The chamber should then be filled with hot kreosot in its liquid state, and be allowed to remain some time.

The patentee here states, that it is impossible to lay down any rule as to the time required for each operation, as the nature of wood differs so materially even among the same species; but that experience will easily teach the workman; and it would be as well to observe that a small test chamber would greatly facilitate the operations of the workman, as he can try experiments upon small pieces of the timber, and calculate from the results obtained how long it will be required to keep the log in the chamber. The timber should be arranged vertically in the chamber if it can be conveniently managed, but if not, it should be placed on an iron grating at the bottom of the chamber, and so arranged that every part of the timber may be acted on by the enpion and kreosot.

The patentee here remarks, that the products of enpion and kreosot may be obtained from other substances than coal tar; but that he prefers obtaining these products from the last mentioned material, owing to its cheapness; and also, that he is well aware that coal tar and such like substances have been heretofore used for the purpose of preserving timber; he, therefore, does not claim, as his invention, the use of tar for this purpose, but only the use of the two before named products, viz. enpion and kreosot, which impregnate the wood and penetrate as far as the heart, and effectually preserve it from the effects of dry rot. Ibid.

Specification of a patent granted to PETER SPENCE, *of the county of Middlesex, for his invention of certain improvements in the manufacture of Prussian blue, prussiate of potash, and plaster of Paris.*—[Sealed 27th July, 1837.]

These improvements consist in the following modes or manners of manufacturing the aforesaid articles, in which I particularly state the various processes that I adopt, and the various materials that I use in my aforesaid manufacture: and, first, with regard to the materials from which I produce my aforesaid articles of manufacture, be it known that I use for this purpose the refuse lime liquor of the gas works, being the bright liquor that swims on the top of the muddy impure lime, after they have been emptied out of the purifying vessels of those gas works which purify their gas by the wet lime, or cream of lime, process; which liquor is named in many of the aforesaid works blue billy liquor. I also use for my aforesaid manufacture the refuse dry lime of those works which use the dry lime mode of purifying, being the aforesaid dry lime after it is taken out of the purifying vessels. I also use various secondary articles, which I shall name when I come to specify the processes in which they are used. From the aforesaid lime liquor I manufacture Prussian blue, prussiate of potash, and plaster of Paris; and from the aforesaid dry lime I manufacture Prussian blue and prussiate of potash. My modes or manners of operation, in my manufacture, are as follows: as I find that the liquors which I receive from the different works, and also those procured at different times from the same works, vary very much in strength, so I find it most profitable to separate the liquors into two distinct classes, according to their strengths, and to adopt two different modes of operation with them: the mode of operation

with the dry lime is also different from the other two modes with the two classes of liquors; so that altogether I have three different modes of operation, which I shall now make known in the order in which I have stated them, that is to say, the two modes of operation with the two classes of liquors, and the mode of operation with the dry lime. But first, I shall state my mode of classing the liquors. In the first class of liquors I place all the weak liquors, being those which require less than one pound of oil of vitriol for the saturation of an imperial gallon; and in the second class I place all the strong liquors, being those which require one pound and upwards of oil of vitriol for the saturation of an imperial gallon. My mode of testing to which class any liquor which I may procure belongs, is the following:—I measure off an exact gallon of the liquor to be tested, and pour it into an earthen jar that will contain from three to four gallons; I then weigh off in a bottle of any convenient shape two pounds of oil of vitriol or sulphuric acid, of the strength of 1.845; I then pour from this bottle a quantity of the acid into the liquor, and adding it gradually until the effervescence begins to grow weak, I then take a slip of litmus testing paper, and when I find that on dipping it into the liquor the paper is coloured red, I stop adding the acid; I then weigh the acid that remains, and the difference in weight is what is required to saturate a gallon of the liquor under trial: if it is less than one pound, then the liquor will belong to the first class, or the class of weak liquors; if it is one pound or more, then the liquor will belong to the second class, or the class of strong liquors.

I shall now describe my mode of operating upon the first class of liquors, being the class of weak liquors. These I receive into large wooden tanks or vats, containing from 4 to 5,000 gallons; in these tanks or vats, when nearly full, I put the liquor through the first or preparatory process; the liquor as I receive it from the works contains a solution of hydro-sulphuret of lime, and hydrocyanate of lime, or prussiate of lime; the real quantity of these being, of course, in proportion to the strength of the liquor; the relative quantities being in most liquors nearly 14 parts of hydro-sulphuret of lime to one part hydrocyanate or prussiate of lime. The object of my first or preparatory process, is to convert the hydrocyanate or prussiate of lime into ferro-hydrocyanate, or ferro-prussiate of lime, to prevent its decomposition in the second or saturating process; and this I effect in the following manner:—for every one hundred gallons of the liquor, I take ten pounds of green copperas, or sulphate of iron, and five pounds of newly slacked quick lime. I dissolve the copperas in water in one vessel, and mix the quick lime with water in another, till it is about the consistence of cream; I then add the solution of copperas to the lime, and after stirring them for a few minutes, pour them into the tank or vat of liquor to be operated upon; the whole body of the liquor must then be stirred for a quarter of an hour, and then be left for twelve hours, when it is ready for the saturating process. The saturating process I perform in the following manner:—the vessel in which I perform this operation is an air tight cask containing three hundred gallons; on the top of this cask I place a stone ware receiver, containing sulphuric acid, and having a stone ware cock fitted into it near the bottom. Below this cock is a funnel of sheet lead, which is soldered to a leaden pipe of one half inch internal diameter, and bent in the form of the letter S. The other end of this pipe is inserted into the top of the saturating vessel, which stands on end, and through this funnel and pipe the acid is conveyed into the liquor. I also insert through the top of the saturating vessel another tube, of three inches internal diameter, being of tin plate. This tube

rises up one foot from the top of the saturating vessel, and then bends off at a right angle, and is carried along horizontally. This tube is for the purpose of conveying away the sulphuretted hydrogen gas, which is thrown off in the saturating process; which sulphuretted hydrogen gas I make use of in a way that I shall afterwards describe.

Into the side of the saturating vessel I also insert a cock, to draw off a little of the liquor to ascertain when it is saturated. In the top of the saturating vessel I also make a round hole of three inches diameter, into which I fit a wooden plug, movable at pleasure. This hole is for the filling of the saturating vessel with the liquor to be saturated. In the side of the saturating vessel, close to the bottom, I make another hole of similar dimensions, into which a plug is also fitted. This hole is for the purpose of emptying the saturating vessel after the liquor is saturated. When I proceed with the saturating process, I draw off the bright liquor, free from any of the sediment from the first process vat, by means of a syphon, the saturating vessel being placed on a lower level: by this means I fill the saturating vessel three-fourths full; I then stop the syphon, put in the top plug into the saturating vessel, and open the cock of the stone ware receiver, allowing the sulphuric acid, or oil of vitriol, to flow in a stream the size of a goose quill. After allowing it to flow for about ten minutes, I draw off a wine glass full of the liquor from the cock in the side of the saturating vessel, for the purpose of testing it, to ascertain if it is saturated. The test I apply is the following:—I dissolve a small quantity of green copperas, or sulphate of iron, in a wine glass full of water; I then pour a small quantity of this solution into the wine glass full of liquor to be tested. If it is not saturated, the liquor immediately assumes a black colour; but if it is saturated, it immediately assumes a light green colour. When, by this means, I find that the saturating process is complete, I immediately stop the cock through which the acid flows. I now draw the plug which is close by the bottom of the saturating vessel, when the whole of the liquor flows out, conveying along with it the sulphate of lime, which the acid has precipitated or thrown down from the liquor. This stream of saturated liquor and sulphate of lime that flows from the plug hole, I receive upon a filter of coarse cloth in a frame five feet square, and suspended over a sunken wooden tank: the clear liquid passes through the filter and the sulphate of lime remains upon it. When it has ceased flowing from the saturating vessel, I immediately replace the plug, and the saturating vessel is then ready for another operation. I then pour three or four pails full of water upon the mass of sulphate of lime on the filter, to drain through any liquor that remains among it. The sulphate of lime is then removed, and from it I manufacture my plaster of Paris in the following manner:—

After making a large bed of about three feet in thickness on any convenient piece of ground, I allow it to remain there for about six months, to drain thoroughly through the action of the rain; I then take it up, and after being burnt or boiled in the ordinary way of manufacturing plaster of Paris from native gypsum, it is then fit for the market.

The saturated liquor, after it passes through the aforesaid filter, is then pumped up into wooden tanks or vats, containing one thousand gallons each. When one of these is filled, I add to it a solution in water of sixty pounds green copperas, or sulphate of iron; a precipitate of a light green colour in a short time falls down from the liquor. The clear liquor is drawn off from this, and run away; fresh water is added, is allowed to settle, and again drawn off; and this is continued till the water comes off tasteless.

The precipitate is then thrown on filters, when it is brought to the consistence of a pulp or paste. This I call my coarse blue, and from it in this state I make fine Prussian blue and prussiate of potash. To make Prussian blue, I proceed in the following manner:—for every one hundred pounds of the pasty coarse blue, I take fourteen pounds of soda of commerce, or an equivalent quantity of other alkali; I dissolve it in ten gallons of water: this solution I bring to a boiling heat, and pour it upon the pulpy coarse blue; I then stir it at intervals for three hours; I then allow it to settle, then draw off the clear liquor, and throw the sediment on a filter, that what remains may drain from it. To every gallon of this liquor, I add a solution of one pound of green copperas, or sulphate of iron, which throws down a dark green precipitate; to this I add muriatic acid, or spirit of salt, till it assumes a deep blue colour; it is then washed till the water comes off tasteless, thrown upon filters, from them placed on chalk stones in a drying house, and then dried off on iron plates exposed to the temperature of from one hundred and fifty to two hundred degrees of Fahrenheit.

In making my prussiate of potash from the pulpy, coarse blue, I proceed in the following manner:—for every one hundred pounds of pulpy, coarse blue, I take nine pounds of the potash of commerce, and dissolve it in two gallons of water; I then add to it the pulpy blue, and bring up the whole to a heat of one hundred and fifty degrees of Fahrenheit. I keep it at this for three hours, with frequent stirring; I then allow it to settle, draw off the clear liquor, throw the sediment upon a filter, and wash out what remains with a little water. I then evaporate the whole of this clear solution till a pellicle forms upon its surface, when I draw it off to crystallize.

The sulphuretted hydrogen gas, which I described before as being carried off in a tube of three inches diameter, I make use of in the following manner:—I carry it onwards to a leaden chamber, constructed upon the ordinary plan of manufacturing sulphuric acid, or oil of vitriol. When within ten feet of the furnace of the chamber, I bend the pipe into an air tight cask three-fourths filled with water, the pipe opening two inches below the surface of the water; the use of this is to prevent explosions of the gas when it gets mixed with air; another pipe of the same size that does not enter the water, conveys the gas to the furnace, when, being lighted, it burns with a large blue flame, and is converted into sulphurous acid gas and watery vapour: these are conveyed by a large pipe into the chamber, when the sulphurous acid gas is converted into sulphuric acid, by the same means as when it is obtained by the burning of brimstone. My sulphuric acid thus produced, I use in my saturating process.

I shall now describe my method of operating upon the second class of liquors, being the class of strong liquors. In operating upon them, I proceed upon the principle of converting the hydro-sulphuret of lime into a sulphuret of lime, at the same time converting the hydrocyanate of lime or prussiate of lime into a ferro-hydrocyanate or ferro-prussiate, to prevent its decomposition; this I effect by the following method:—for every one hundred gallons of the liquor to be operated upon, I take six pounds of green copperas, or sulphate of iron, and dissolve it in sixteen gallons of water; to this I add two gallons of the ammoniacal liquor of the gas works: I then allow the precipitate to settle, pour off the water, and put on fresh water; repeating this till the water comes off tasteless; I then put the sediment among the liquor to be operated upon, then put the whole into an evaporating vessel, and evaporate it down to perfect dryness, taking care that the heat be so moderated in the last stage of the process, as not in the least de-

gree to burn it; I then take the residual substance out of the evaporating vessel, and reduce it to a coarse powder; and from this powder I produce Prussian blue and prussiate of potash in the following manner:—to make Prussian blue, for every one hundred pounds of the coarse powder, I take fourteen pounds of the soda of commerce, or an equivalent quantity of other suitable alkali, and dissolve it in sixteen gallons of water; this I bring to a heat of one hundred and fifty degrees of Fahrenheit; I then pour it on the powder, and stir every quarter of an hour for three hours, I then allow it to settle, draw off the clear liquor, throw the sediment upon a filter, and pour over it six gallons of water, at one hundred and fifty degrees Fahrenheit; I add the liquor which comes through the filter to that which was poured off; I then put the whole into a pan, and bring it to a boil; I now add to it a substance that will abstract a quantity of sulphur, which the soda has dissolved, and holds in solution for this purpose. I can use the black oxide of manganese, or the yellow oxide of lead, named litharge; but I prefer using, as cheaper, the red oxide of iron, obtained from the decomposition of pyrites by heat; this I reduce to powder, and wash thoroughly, to separate any sulphate of iron that might cling to it, for the quantity of liquor to be operated upon as aforesaid. I take a quantity of this oxide of iron, equal to six pounds of it, in a dry state, and put it into the boiling liquid, stirring till it be thoroughly mixed, then boil it for ten minutes, and then empty it into a settling vessel; when the liquor brightens, it is drawn off, the sediment thrown upon a filter, and any that may remain among it is washed out with two or three gallons of water: to this clear solution I now add eight pounds of green copperas, or sulphate of iron, dissolved in water, which throws down a dark green precipitate; on this I pour muriatic acid, or spirit of salt, till it assumes a deep blue colour; it is then washed, filtered, and dried, in the same way as the Prussian blue from the first class of colours.

To make prussiate of potash from my aforesaid coarse powder, I proceed as follows:—for every one hundred pounds of the coarse powder, I take eight pounds of the potash, or nine pounds and a half of the pearlash of commerce, and dissolve it in twelve gallons of water, bring the solution to a heat of two hundred degrees of Fahrenheit, and then pour it on the coarse powder; I stir it frequently for two hours, and then add eight gallons of water at a boiling heat, stir, and then allow it to settle; I draw off the clear liquid, throw the sediment on a filter to drain, and then wash it through with six gallons of water, at two hundred degrees of Fahrenheit: the liquor passed through the filter I add to that drawn off; I put the whole into a pan, and bring it to boil; I then add eight pounds of the aforesaid oxide of iron, and boil for ten minutes; it is then drawn to separate the sediment, after which the bright liquor is returned into the evaporating pan and boiled down till a pellicle forms on its surface, when it is drawn into the crystallizing vessel to crystallize.

I now come to describe my process with the refuse dry lime of those gas works which use the dry lime mode of purification, being the aforesaid refuse dry lime after it is taken out of the purifiers, this I find to contain chiefly sulphuret of lime (or calcium,) carbonate of lime, and cyanide of lime (or calcium;) and the two former not being soluble to any great extent, while the latter is converted into hydrocyanate, and dissolved when it comes into contact with water: in accordance with these statements, I proceed in the following manner:—having put a quantity of the dry lime into a large wooden vat, I let in water heated to about one hundred and fifty degrees of Fahrenheit, till the lime is thoroughly soaked, and the water

stands about a oot above the mass, and then it is beaten about till well broke; it is then allowed to remain, with occasional stirring, for eight hours, when it is allowed to filtrate out by a cock at the bottom of the vat; this liquor is set aside for using at once:—more water is then added to the mass, is allowed to filtrate through, and is then used for another quantity of dry lime.

To make Prussian blue from the aforesaid liquor first run off, I proceed as follows, and I bring the liquor to boil:—for every one hundred gallons, I use twenty pounds of the dry oxide of iron, allow it to boil for ten minutes, and withdraw it into a settling vessel; when well settled, the liquor is drawn off; to this liquor I then add a solution of muriate of iron, as long as any precipitate is thrown down; muriatic acid, or spirit of salt, is then added, until it assumes a deep blue colour; it is washed, filtered and dried, in the same manner as before specified.

To make prussiate of potash from the before-mentioned liquor, I dissolve a quantity of the potash or pearlash of commerce in as small a quantity of water as will dissolve it; I then add it to the liquor as long as a white precipitate is thrown down; I then allow this precipitate to settle, and draw off the clear liquor, bring it to boil, and for every pound of alkali used, I take a pound of the red oxide of iron, boil it ten minutes, then withdraw it to separate the oxide; I then return the liquor into the evaporating pan, and boil down till a pellicle forms on its surface, when it is run into the crystallizing vessels to crystallize.

Having thus described the nature of my invention, and the manner of carrying the same into effect, I would remark, that I lay no claim to the producing sulphuric acid from the sulphuretted hydrogen, evolved in what I have called the saturating process; and I have only mentioned it for the purpose of pointing out the most advantageous mode of carrying on the other processes; nor do I claim the production of prussiate of potash from Prussian blue generally, and I am aware that Prussian blue, admixed with sulphate of lime, has been proposed to be obtained from lime liquor; I do not, therefore, claim the manufacture of a product so combined, or in a state of admixture the one with the other; but what I do claim as my invention is, first, the production of the three separate products, Prussian blue, prussiate of potash, and plaster of Paris, or either of them, uncombined with other matter, from what I have called weak liquors, being the refuse lime liquors of the gas works, as above described.

Secondly, the producing the two separate products, Prussian blue and prussiate of potash, or either of them, uncombined with other matter, from what I have called strong liquors, being the refuse lime liquors of gas works, as above described.

And, thirdly, I claim the production of Prussian blue and prussiate of potash, or either of them, uncombined with other matter, from the refuse dry lime after it has been employed for the dry lime process of the gas works, as above described. Ibid.

Specification of a patent granted to CHRISTOPHER NICKELS, *of the county of Surrey, for improvements in preparing and manufacturing caoutchouc, applicable to various useful purposes, being partly a communication from a foreigner residing abroad.* [Sealed 24th October, 1836.]

The subjects of invention claimed under this patent, are described under

seven heads: first, a mode of producing threads of caoutchouc from the refuse strips or cuttings; second, machinery for producing the first described object; third, cutting off threads from the edges of a series of disks of caoutchouc; fourth, spirally twisting round strands of caoutchouc, yarns of cotton or silk, or other fibrous materials, for the purpose of guarding the caoutchouc from wear; fifth, rendering fabrics water-proof and air-tight by means of caoutchouc, without dissolving it; sixth, weaving elastic ornamental webs or fibres; and seventh, the application of caoutchouc to the purposes of binding and covering books.

Under the first head, the patentee describes the ordinary methods of cutting bottle or cake India rubber into thin strips; and states that a great waste of the material takes place from the quantity of small pieces which are pared off and become refuse and useless.

These refuse pieces the patentee washes in hot water, in order to remove all the dirt, and then introduces them into a sort of mill, where they are ground and masticated; and the caoutchouc, after thus treated, is discharged in a plaster, or semi-fluid state. The caoutchouc, so prepared, is then put into a powerful hydraulic press, and kept in that press until it becomes set, and sufficiently hard to be cut into sheets or strips.

The internal form of the receiving vessel of the press is cylindrical, with a corresponding plunger, and therefore the cake of India rubber, when set and hard, assumes a cylindrical shape, which may be readily cut by a knife, or other cutting apparatus, into disks; or the cylindrical vessel may have a cylindrical core in the middle of it, and then the cake, when set, will be of a pipe or hollow cylindrical form, and the pieces sliced off from it will be rings.

The machinery for grinding the India rubber has teeth not much unlike other metallic mills, and by the rotation of the working parts, the material (previously heated) is so worked up as to become one mass. The press may retain the mass or material, as described, until it has become a solid compact cake; or it may be forced out on the side of the press, and passed between rollers, for the purpose of being forced into sheets, and lapped upon a roller. Under this head a machine is described in which the cylindrical block of India rubber may be cut, by means of rotary circular knives, into disks or into rings; the block of India rubber revolving slowly, whilst the circular knives turn rapidly; or the lapped sheets may be cut into tape, by a spiral action of the cutter. The patentee, however, does not appear to intend claiming the invention of any precise form of machinery, but only a convenient mechanical means of effecting the operation.

Under the third head, a machine is described for cutting threads of India rubber from the edges of a series of disks, which may be reduced into fine strands, by a drawing process, like wire: the fourth head points out the means of coiling threads of cotton, silk, or other material round the strands of India rubber; the fifth, the proposed mode of rendering fabrics waterproof; the sixth, of weaving ornamental elastic fabrics; and the seventh, of applying India rubber, in several ways, to bookbinding. But the patentee has, since inrolling his specification, found it necessary to disclaim the third, fourth, fifth, sixth, and seventh heads of his invention, as not new at the time of granting his patent.

Ibid.

Specification of a patent granted to George Herbert James, *of the city of London, wine merchant, for an improvement in making bread, being a communication from a foreigner residing abroad.*—[Sealed 23d January, 1838.]

The specification of the patentee is as follows:—In order to produce the best possible bread, viz. that which shall be most nutritive, and, at the same time, the most easy of digestion, the following conditions ought to be strictly observed, that is to say, first, that the flour used in the process should be rich in gelatine, and not charged by incipient fermentation; secondly, that the dough should be perfectly combined with the water, and not compact or close, thirdly, that the bread shall be well risen or leavened, that is to say, that the primary fermentation should have been well performed; fourth, that the bread should not be sour, and not overbaked.

Now, it has been proved that bakers do not cause the water used in making bread to combine with the flour in a proper or suitable manner, and this defect in the process renders the bread much less nourishing, and more difficult of digestion. Bread made according to the usual method does not retain a sufficient quantity of water in it, as a great portion of this fluid, so useful in digestion, evaporates by the action of the oven or furnace, by reason of its not forming an integral part of the flour; and, accordingly, the nature of this invention of an improvement in making bread, mentioned in the said letters patent granted to me, consists in previously combining with the water used in making the bread, a portion of flour of the first quality, by causing it to undergo the process of boiling or ebullition; and, in using the mixture or composition thus produced in lieu of pure water, for, by this process, the water becomes so completely combined and incorporated with the flour, that the heat of the oven will cause but a very small portion of it to evaporate, and the bread produced is of a more nutritive quality, and, at the same time, of easier digestion.

The best manner in which the said invention can be performed is, to the best of my knowledge, the following: that is to say, for one sack of flour, weighing 280 lbs., take 10 lbs. of flour, which should be of the first quality, which is to be diluted in 20 quarts of cold water; then boil in the steam caldron, which is the best utensil for the purpose, 55 to 60 quarts of pure water; and when the 55 to 60 quarts of pure water are in a perfectly boiling state, or bubbling state, add thereto, and in small quantities at a time, the diluted flour, being very careful to stir without ceasing the boiling liquid. When all the diluted flour has been so added, the boiling of the entire mixture must be so continued during a quarter of an hour at least, or, in other words, till the flour is thoroughly and completely combined with the water, forming a gelatinous size or starch. The entire mixture must then be taken off the fire, and strained through a sieve, in order to free it from any particles of flour which may have formed into lumps. By using this mixture, which has the appearance of thin starch, cooled to 75 degrees of Fahrenheit's thermometer, instead of pure water, bread of a finer appearance and lighter quality, more nourishing, and of easier digestion, will be produced, than that obtained from flour of the same quality, where the method in ordinary use with the bakers has been followed; to which may be added, that the proceeds will be more abundant, inasmuch as from 106 to 107 baked loaves, each of the weight of 4 lbs., may be produced, by this process, from the before named quantity of 290 lbs. flour.

In other respects, the bread is to be made in the usual way, except that it would be proper to add to it a rather larger portion of salt, say 12 ounces, to the hydrated flour. And I hereby declare, that my claim to the said invention of an improvement in making bread is limited to the preliminary combination of flour with water, in the manner hereinbefore described, and to the application of the diluted or hydrated flour so produced, instead of pure water, in the process of making bread. Lond. Jour.

Specification of a patent granted to William Hinckes Cox, *of Bidminster, near Bristol, tanner, for his invention of an improvement or improvements in tanning hides and skins.*—[Sealed 15th September, 1836.]

The patentee commences his specification by describing the disadvantages of the different modes of tanning at present in use, and then points out the beneficial effects which will result from the adoption of his improved method of tanning. He first informs us that the ordinary method of tanning, and that process which is now most generally in use, is by subjecting the skins or hides after they have been deprived of the hair, to a process of steeping in pits, until, by the action of the tanning liquor, the hides or skins may be considered to be sufficiently tanned, which will be readily known to any person who is conversant with this branch of manufactures.

Now, this process of tanning is one which takes a long time, generally several months, before the skins or hides are considered to be tanned sufficiently; and many schemes have been proposed and tried, by means of which the duration of this process might be considerably shortened, and even confined to a few hours. Among others, one method proposed was, by joining two skins or hides together at their edges, by means of metallic clamps or frames, and thereby forming a sort of bag, into which the tanning liquor was poured, and by hydrostatic pressure forced through the pores of the skins or hides.

This process, however, is liable to serious objections, as the effect of the pressure would be to distend and strain the skins or hides, and separate the particles of which they are composed, and by this means considerably weaken them, owing to their being supported by the metallic clamps at their outer edges only. Now, this is highly prejudicial to the object to be accomplished, it being desirable rather to condense the skins or hides than distend them; and this evil is still more seriously apparent, when there are any weak places in the skins or hides; so that the advantages which may appear to result from this process, are more than counterbalanced by the disadvantages that have been pointed out.

Since this method has been put into operation, and found to fail, from the causes hereinbefore stated, another method has been tried, which although not quite so injurious, is still liable to the same objections, viz.: the distension of the skins or hides, when the hydrostatic pressure is employed: for the plan is supporting the sides of the hides or skins by rigid bars of iron or wood with spaces between them. It was supposed that these bars would counteract any prejudicial strain which the hydrostatic pressure might occasion; but by this apparatus the skins or hides are only partially supported; those parts which are not actually in contact with the bars are consequently unsupported, and bag between the bars, which causes those parts to be distended by the pressure, whilst those which are supported by the bars are not so effectually acted upon by the tanning liquor; and although to remedy this latter evil it was proposed to shift the position of the skins

or hides so as to make the tanning liquor act equally on every part, yet no even effect could be obtained, and thus this process was rendered but very imperfect.

The Patentee now proceeds to inform us that his invention consists in fastening or sewing together two or more hides or skins, so as to make a bag to contain the tanning liquor, and supporting the sides of the hides or skins by means of fibrous materials, which, while they give the required support, yet allow the tanning liquor to ooze out or percolate through the skins and pass away, the fibrous materials being sufficiently pliant to accommodate themselves to the shape or figure of the bag or skins, without allowing one part to be subjected to a greater pressure than another.

The Patentee also states, that the material which he prefers to use, and which by experiment he has found to answer the purpose best, is a sort of coarse canvass of rather an open texture, such fabric being suitable for giving a close and equal support to every part of the bag composed of the hides or skins, and also admitting of a free passage of the liquor, and allow it to flow away after it has percolated through the pores of the hides or skins.

The improved process is thus described:—I take a skin or hide that has been previously prepared with a backward ooze, for the purpose of bringing it into a suitable condition for receiving a stronger liquor, and of giving it a good leather color. The outer edges are to be sewed together tightly with well waxed thread, for the purpose of forming a bag, a small opening being left at one end for the purpose of introducing the tanning liquor; and should any holes be discovered, they must be sowed up, when the bag will be ready to be hung up to receive the tanning liquor.

The Patentee prefers having the flesh side of the skins inwards, as more calculated to receive the tanning liquor with facility.

The hides or skins being thus made into a bag, are then suspended from two hoops in such a manner that they may hang clear from the ground; and gutters should be made beneath them for the purpose of receiving the tanning liquor, which oozes through and drops on to the ground, in order to convey it into pits or tanks made for that purpose. A covering of coarse canvass is then to be placed round each bag, in the edges of which eyelet-holes are made for a lacing string, so that the canvass bag or covering can be drawn up and laced closely round the hides, and an equal support is afforded on all sides.

The bag or skin is then to be filled with the tanning liquor, which is conveyed to it by a pipe from a tank placed in a suitable situation for that purpose; and in order to carry on the process with expedition, a suitable shed or building should be conveniently arranged for having a number of these bags hanging in a row, in such a manner that one pipe running along the extent of the shed, and supplied with suitable branch pipes, might supply the whole number of the bags, each branch pipe being supplied with a stop cock for turning on or cutting off the tanning liquor.

The branch supply pipe to each bag should be inserted into the opening at the top of the bag, and the skin tied tight round it to exclude the air; and each bag must be furnished with a stop cock at the top, which should be open while the tanning liquor is running into the bag, for the purpose of allowing the air in the bag to escape.

The supply pipe being thus inserted into the upper part of the bag, the pressure of the tanning liquor will be as the perpendicular height of the column, the liquor will percolate through the pores of the skin, and rapidly

produce its effects thereon. As the liquor oozing through the pores of the skins, with the leakage that may take place, tends to lessen the quantity of liquor in the skins, so its place will be supplied from the tank through the open supply pipe.

The time that may be allowed for completing the process will, of course, depend on the nature, thickness, and quality of the hides, and perhaps from other causes, as is generally the case in the process of tanning; but any person who is conversant with the process, will readily know when the desired result is obtained; but the operator may know with certainty what effect is produced by cutting away a small portion of the outer surface of the skin.

When the hides or skins are deemed sufficiently tanned, an aperture is made at the bottom of the bag by cutting away some of the stitches, and the tanning liquor allowed to flow out; the edges are then cut off, and the skins afterwards dried and finished in the usual way.

The Patentee says, in conclusion, "having now described the nature of my invention, and the manner of carrying the same into effect, I would remark that other materials may be employed for making the canvass covering for the bags than that above described, without departing from my invention, though I consider the material above described to answer the purpose best; therefore, I do not intend to confine myself to any particular material for covering or giving support to the hides or skins; and I would also have it understood, that I lay no claim to the forming of hides or skins into bags for the purpose of suspending them, and causing the tanning liquor to percolate through; nor do I lay any claim to giving external support to the skins, when this support is given by rigid bars or surfaces pressing on parts and leaving other parts unsupported, and by this means producing an unequal effect; but what I claim as my invention is, the application of a covering or support made of fibre, which is capable of giving an even and close support to all parts of hides or skins on one side thereof, when pressed on the other side by the tanning liquor, at the same time such cover of fibres will allow of the tanning liquor readily flowing away through it after having passed through the pores of the skins or hides, as above described." Ibid.

Specification of a Patent granted to William Neale Clay, *of the county of Stafford, and* Joseph Denham Smith, *of the borough of Southwark, for their Invention of certain Improvements in the Manufacture of Glass.*—[Sealed 16th November, 1837.]

This invention consists in the application of certain materials in the manufacture of glass, not heretofore so used, by which we are enabled to obtain various descriptions of glass of an excellent quality, and at a reduced cost; such materials being used with the matters now employed, or in substitution for some of the matters now used in the various mixtures for making glass, which is brought to market under various denominations, the names of such glass depending, in some respects, on the process through which it passes, and the uses to which it is applied; but all glass-making may shortly be stated to be the fusing of silica at a great heat, with certain saline or alkaline substances, and, in some cases, the oxides of lead at the same time. There are probably no two glass-makers engaged in making glass which is sold by the same name, who would agree as to the mixtures to be used; and, as far as our experience goes, we have not found any two

makers, either of flint glass, crown glass, plate glass, or glass under other names, who employ the same quantities of ingredients; and, in some cases, different makers vary the materials from which the same named glass is manufactured.

We are, therefore, unable to set forth any general rule of glass-making for any of the various named glasses; at the same time, the materials which we apply to the purpose of improving the glass manufacture in general, will, with greater or less advantages, apply to the various mixtures used by different glass manufacturers. We, therefore, propose to give such mixtures of silex, and the materials ordinarily in use, with such quantities of the materials now to be newly applied, according to our invention, as will be suitable to the making of flint glass.

The various processes of glass-making being well known to glass makers, no description will be required for performing the same, such processes constituting no part of our invention: nor are the processes of fusing of the mixtures, nor the subsequent treatment of the glass to produce the various named glasses, changed or altered. The invention relating to the application of certain materials not hitherto so used in combination with silex and other matters for making glass.

And our invention consists, first, in the application of combinations and salts of barium, strontium and zinc; and, secondly, in the application of granitic, or other rocks abounding with felspar.

In using combinations, or salts of barium, or of strontium, we prefer the carbonates of barytes or strontia which are found native in some parts of this kingdom; or otherwise, for them to be in the state of sulphate of barytes; in which latter case we mix a proportion of charcoal, or other carbonaceous substances.

In using combinations or salts of zinc, we prefer the oxide of zinc which is formed during the process of manufacturing that metal.

Mixture for making glass by combining combinations, or salts of barium, with silex and other materials: Sand, 320 parts by weight; red lead, 150 parts by weight; carb. barytes, 145 parts by weight; carb. potash (pearl ash,) 112 parts by weight; nitre, 7 parts by weight; some little oxide of manganese (the usual quantity.)

Mixture for making glass by combining combinations, or salts of strontium, with silex and other materials: Sand, 320 parts by weight; red lead, 150 parts by weight, carb. strontia, 108 parts by weight; carb. potash (pearl ash,) 112 parts by weight; nitre, 7 parts by weight; oxide of manganese as usual.

Mixture for making glass by combining compounds, or salts of zinc, with silex and other matters: Sand, 320 parts by weight; red lead, 150 parts by weight; oxide of zinc, 56 parts by weight; pearl ash, 112 parts by weight; nitre, 7 parts by weight; oxide of manganese, some little as usual. In some cases we do not use red lead (oxide of lead,) but then we double the quantities of carb. barytes, carb. strontia, and oxide of zinc, respectively.

Other descriptions of glass we make with the following mixtures:

	Parts by weight.		Parts by weight.		Parts by weight.
Sand - - - - -	480	Sand - - - - -	480	Sand - - - - -	480
Carb. barytes - -	300	Carb. strontia - -	224	Oxide zinc - - -	120
Carb. soda (pure)	165	Carb. soda (pure)	165	Carb. soda (pure)	165
Little oxide of manganese.		Little oxide of manganese.		Little oxide of manganese.	

Further mixtures:

	Parts by weight.		Parts by weight.		Parts by weight.
Sand - - - -	280	Sand - - - -	960	Sand - - - -	960
Chalk - - - -	88	Chalk - - - -	200	Chalk - - - -	200
Sulph. soda - - -	84	Sulph. soda - -	290	Sulph. soda - -	290
Sulph. barytes - -	90	Sulph. barytes - -	460	Sulph. strontia -	370
Charcoal - - - -	8	Charcoal - - -	40	Charcoal - - -	40
Little manganese.		Little manganese.		Little manganese.	

These mixtures form cheaper glasses, as they enable the manufacturer to use less alkaline or saline substances than before.

We will proceed to give mixtures of the application of those rocks in which felspar predominates, and which, at the same time, contain very little or no oxide of iron; as, for instance, a mineral found in Cornwall, and used in the potteries under the name of "Cornish Stone;" this we use in conjunction with common salt or muriate of potash, and we find these mixtures to afford good and cheap glass.

	Parts by weight.		Parts by weight.
Cornish stone powdered fine as sand - - - - - - - -	100	Cornish stone powdered fine as sand - - - - - - - -	100
Common salt - - - - - - -	12	Common salt - - - - - - -	16
or		or	
Muriate of potash - - - -	16	Muriate of potash - - - -	22
Chalk - - - - - - - - -	20	Chalk - - - - - - - - - -	16

Having thus described the nature of our invention, and the manner in which the same is to be performed, we would remark, that although we have given particular quantities of the various materials in the mixture, we do not confine ourselves thereto, and the glass manufacturer will readily adapt our invention to the object he desires: for, it will be seen that an important feature of our invention is, in some cases, to reduce the necessity of using so much red lead, and, in other cases, to dispense with the use of red lead altogether, and, in other cases, to reduce the extent of using alkaline or saline substances, by the application of other materials. Hence, supposing a glass-maker is about to apply any of the substances herein mentioned, as constituting our improvements in the manufacture of glass, and supposing him to have a particular mixture of his own, which, as before stated, is most generally the case, he will apply some one or more of the matters herein mentioned, for it is not necessary that only one of the matters should be employed in any particular mixture.

And we would have it understood that we lay no claim to the using of any of the other materials herein described, nor do we confine ourselves thereto, as there are other materials used in glass-making, for various purposes, and as is well understood. But what we claim, as the first part of our invention, is, the application of compounds, or salts of barium, strontium, and zinc, in combination with silica and other materials, in the manufacture of glass; and, secondly, we claim the application of granitic or other rocks in which felspar predominates, in the manufacture of glass.—

Progress of Practical and Theoretical Mechanics and Chemistry.

Percussion Tubes for Cannon. By James Marsh, *of the Royal Arsenal at Woolwich.*

Mr. Marsh's invention is peculiarly adapted to ships' guns, and consists of two distinct improvements, one relating to the tube, and the other to the explosive composition with which the tube is filled.

In those ships' guns which are discharged by means of a common flint lock, a cord (in sea phrase a lanyard) is fastened to the trigger, in order that the gunner, while standing clear of the recoil, may be able to fire it at the instant that the object aimed at comes in a line with the sights; for, as both the antagonist ships are in a state of motion, it is evident that the least delay will, in all probability, occasion the mark to be missed. In adapting percussion powder to the discharge of cannon, the lock was entirely removed, and replaced by a hammer moving on a pivot, which, being first brought into position merely by throwing it back, is then, by pulling steadily and without jerk at the lanyard, made to descend with considerable force, striking the gun about half an inch short of the touch hole. A quill, charged with meal gunpowder, was thrust into the touch hole, having a short lateral pipe of thin sheet copper attached to it at right angles near the upper end: this pipe was charged with percussion powder, and care was taken, in putting the quill into the touch hole, that the pipe should project directly over the place where the hammer would fall; it thus received a blow which caused the percussion powder to explode, and this, setting fire to the meal powder in the quill, discharged the gun.

To this plan there were two objections; one, that the gun often missed fire; for, although percussion powder is easily exploded by a sharp blow, yet a heavy slow one often fails to produce the desired effect, and it is difficult to give the hammer sufficient rapidity of descent by pulling at the lanyard. The other objection is, that the force of the explosion projects the copper tube with so much violence as to wound the people standing near.

The latter of these objections Mr. Marsh has removed by substituting the barrel of a crow quill for the copper tube, and the former in the following way:—

The common composition for percussion powder is the same as that used for the lucifer matches, viz. equal parts of sulphuret of antimony and of chlorate of potash. These ingredients are separately rubbed to fine powder, and then mixed intimately by running them through a fine sieve, and are then made into a paste by thin starch or gum water. It is well known that gunpowder itself, and many other explosive compounds, will bear any degree of dead pressure, and may even be rubbed in a mortar without exploding, but the presence of a few grains of sand, or any other hard, gritty substance, with even moderate friction, will occasion immediate explosion; on which account, the common lucifer matches, when drawn smartly through a piece of folded sand paper instantly take fire. Mr. Marsh, proceeding on this principle, mixes with the ingredients already described, half their weight of finely pounded green glass. There is also novelty and good sense in the manner in which he charges the quill. He first moistens the meal powder with a mixture of thin gum water and alcohol, and then rams it into the main barrel of the quill, and charges the lateral one in like manner, with the percussion powder slightly moistened. After the whole has become dry, he

introduces a piercer up the middle of the larger barrel, and a smaller one up that of the lateral barrel, thus forming a connected tube from the outer end of the lateral barrel to that of the other. The consequence of this is, that when the hammer falls the percussion powder instantly explodes, sending a flash through the middle of the gunpowder, and setting fire to that likewise. The flame of the gunpowder, meeting with no resistance to its descent, rushes through the perforation and instantly fires the gun. The effect of this arrangement was shown by an actual experiment on the model of the breech of a gun before the committee. A charged quill was put into the touch hole, and a metal pipe was screwed to the bottom of the touch hole, making the entire length, from the quill to the end of the pipe, at least two feet. About half an ounce of gunpowder, tied up in a piece of the same kind of thick woolen cloth as common cartridges for cannon are actually made of, was laid on a board just beneath the end of the tube, and, on pulling the lanyard, the contents of the priming quill exploded, and a body of flame darted down the metal tube, pierced through the woolen cloth, and set fire to the gunpowder wrapped up in it.

Mr. Marsh's priming quills have been tried, by order of the Board of Admiralty, on board the Excellent, the experimental ship at Portsmouth, with entire success, there not being a single missed fire in 900 rounds. In consequence of which the Admiralty have made him a pecuniary present, and have already adopted its use in many of the ships of war now in commission.

Mr. H. Wilkinson, one of the committee, stated, that he has made comparative experiments with percussion powder, made of chlorate of potash and sulphuret of antimony, and Mr. Marsh's composition, and finds that the former requires a far sharper blow to cause it to explode than Mr. Marsh's does: he has also ascertained that neither fulminating mercury, nor even fulminating silver, alone, are so easily exploded as Mr. Marsh's powder is.

Trans. Society of Arts.

Silk, raw and manufactured, from Lower Assam.

The Society of Arts have received from the Agricultural and horticultural Society of India, some specimens of silk, both raw and manufactured, sent to them by Captain Francis Jenkins, agent to the Governor General on the N. E. frontiers of Bengal. They are from the neighbourhood of Gowahatty, in Lower Assam, and are the produce of two species of caterpillars, different from that which produces the true silk.

One of them is called "the worm of the moonghatree." Of the silk of this insect, two samples in the raw state, that is, merely wound off the cocoon, have been received, and two plain cloths manufactured in Assam from the same silk.

Both the samples of raw silk have considerable lustre, and have a reddish cast of colour. One of them is too coarse for ordinary use, but appears likely to be valuable for sewing silk, for which there is always a large demand, and, the sample being more than usually clean for so full a size, it would, probably, meet with a ready sale, if reeled from the cocoon in large skins. The other sample is similar to, but of better quality than, the former.

Of the two cloths manufactured from this silk, one bears a resemblance to Indian taffeta, and the other to China crape. From the state in which

the Society received them, it was evident they had undergone no process of bleaching or softening; the committee, therefore, directed that a square of each should be well boiled in soap and water for several hours. This was done, and the cloths were considerably improved in softness, colour, and lustre; the colour, however, still remained similar to that of pale nankeen, and the lustre inferior to that of true silk. The above samples, both raw and boiled, having been shewn to a silk manufacturer in Macclesfield, were recognized by him as being exceedingly like some which had come into his hands under the name of *jungle silk*, and which, when treated in the usual manner, was found to be too deficient in colour and lustre to answer as a substitute to similar fabrics made of true silk.

The other kind of silk is called by Captain Jenkins Area silk, and the insect which yields it feeds on the leaf of the castor oil plant (Ricinus communis,) and, in case of necessity, it will feed also on the leaves of the Kaura, (Sapium sebiferum) and of the Jetropha manihot. Captain Jenkins farther says, that it is twisted, by hand, into coarse thread, of which are made large heavy blankets, which are almost indestructible, descending, literally, in constant wear, from father to son. He farther states, that the samples sent, being new, give no adequate idea of the degree of softness to which it is brought by long wear and frequent washing.

Of the Area thread two varieties have been received, one of a dirty white colour, and the other of a yellowish brown; the latter being considerably harsher than the former, though superior to it in lustre. The thread is composed of very fine filaments, each individually having considerable lustre; but as they have evidently been made into thread, not by winding from the cocoon, but by spinning by hand, probably after being coarsely carded, the lustre of the thread, as well as of articles made from it, can scarcely be greater than that of *spun silk*. The thread, besides, is as ill made and uneven as possible, and very dirty, no doubt from the manner in which it is made, being merely twisted by rolling it between the hand and the thigh.

The Area silk seems greatly to resemble a kind described by Dr. Roxburgh in vol. vii. of the Linnæan Transactions, by the name of Arindy silk, produced by the Phalæna cynthia, and which he says, is cultivated in Bengal, in the districts of Dinagepour and Runghpour: its cocoons are either white or yellowish brown; and the filament is so fine that the natives do not attempt to reel it, but pull it off the cocoon and spin it like cotton.

A square of each of the cloths of Area silk was boiled in soap and water: much dirt was extracted, the colour was improved, though still it was far from white; and though the fringed or ravelled edges had more or less of a silken lustre, yet the coarser of the two cloths still remained as dull as nankeen, which it considerably resembles; whereas the other, which is of a lighter and looser texture, is by far the softer of the two, and shews some lustre, which repeated washings would probably increase. Ibid.

Articles from the French Journals. Translated for the Journal of the Franklin Institute, by J. Griscom.

Caramel.

When common sugar is heated to the temperature of 210 to 220° Cent. and maintained at that degree of heat, (which may be easily done by means of an oil bath,) it swells, and a strong, and as it were, spontaneous reaction takes place among its elements; the sugar acquires a brown tint, which be-

comes more and more dark. *Not the smallest quantity of permanent gases escapes from it*, but much watery vapour is disengaged, which, when condensed, exhibits traces of acetic acid, and an oily matter which exhales, faintly, the odour of burnt sugar.

When the swelling has ceased, there is found in the retort a black substance, having the brilliant aspect of anthracite. It is entirely soluble in water, and the solution has the rich tint of the sepia, and retains none of the sweet taste of the sugar. It is as insipid as gum arabic, and shews not the least sign of fermentation under the action of yeast. Such are the characters of this substance in a state of purity, and though it may not be immediately obtained in this state, it may be procured by treating the contents of the retort once or twice with alcohol, after having dissolved it in a very small quantity of water. If sugar remains, the alcohol dissolves it as well as an accidental substance which occasions the peculiar bitterness of burnt sugar. The product being insoluble in alcohol, is precipitated.

The substance now in question having some analogy to the caramel of the shops, which is a mixture of sugar with this substance itself, I give it the name of *caramel*, to avoid the embarrassment of a new term.

Caramel, dried at 180° Cent., has appeared to me of uniform composition. Its analysis is accomplished with much difficulty. As it does not melt, it has a tendency to leave a residuum of charcoal of extremely difficult combustion. I obtained the following results:—

	(1)	(2)	(3)	(4)
Carbon	46.6	46.	47.56	46.9
Hydrogen	6.1	6.1	6.2	6.3

These numbers agree with the formulæ.

C^{48}	1836.4	47.5
H^{36}	224.6	5.9
O^{18}	1800.0	46.6
	3861.0	100.0

It will be observed that caramel, like sugar, contains hydrogen and oxygen in the proportions which constitute water; and also, that to be transformed into this product, the sugar loses four atoms of water, which is confirmed also by direct experiment. Caramel therefore, has the composition of anhydrous sugar, as it exists combined with the oxide of lead.* It is impossible to conceive of a more simple decomposition.

Sugar of starch, of diabetes, and of grapes, subjected in the same way to the action of heat, is transformed into a product identical with the caramel procured from common sugar. A greater quantity of water, however, is disengaged, and the operation is more difficult, on account of the great ebullition which takes place during the decomposition.

Caramel acts the part of a weak acid; it precipitates the ammoniacal acetate of lead very abundantly; it forms with barytic water, a voluminous precipitate, which does not dissolve, even in warm water, and which contains, as I have found, 20 to 21 per cent. of barytes.

It sometimes happens, that in the preparation of caramel, the heat becomes so great, or its action is so prolonged, that the body is decom-

* This the author had established in a preceding part of his elaborate memoir on the nature and chemical properties of Sugars. Ann. de Chim. et de Phys. tom. lxxvii. p. 124.—Trans.

posed, by simply losing an additional portion of water. The substance which remains is not soluble, and may be easily separated from caramel itself. It contains hydrogen and oxygen in the same proportions as the products from which it is derived. If, in short, the heat be continued sufficiently, the combustible elements react on each other, and the ultimate decomposition is effected, which is the only kind that had, until the present time, been observed.

It is very probable that the greater number of substances, which in composition are analogous to sugars, would furnish, at a suitable heat, substances like that we have now described. A study of this kind, directed for example to lignite, might easily lead to an explanation of the formation of the acetic acid which the decomposition of wood yields in variable quantity, dependent on the manner in which the distillation is regulated.

EUGENE PELIGOT. Ann. de Chim. et de Phys. Feb. 1838.

Composition of Resin.

The March number (1838) contains an interesting memoir of more than 30 pages, on the "*Chemical examination of the products arising from the employment of Resin for the purpose of Gas Illumination.*" By M. M. Pelletier and Philippe Walter.

The results of this investigation, as summed up by the authors themselves, are thus stated,—

"It follows from what precedes,

1st. That at the moment when resin falls into a cylinder at a bright red heat, as is practised at the gas works, there is formed, concurrently with the illuminating gas, and with carbonic and acetic acid, a great number of very hydrogenated products, which we have succeeded in separating by the means which analytic chemistry now furnishes.

2d. That among these substances are three new kinds of carburetted hydrogen which we have described under the names of *retinapthe*, *retinyle*, and *retinole*, and two *solid carburets of hydrogen*, naphtaline, already known, and metanaphtaline, a new substance.

3d. That retinaphte is a very light, volatile liquid, whose composition, determined by analysis, may be represented by $C^8 H^{16}$, which renders it at least isomeric with a carbonated hydrogen, still hypothetical, which appears to act an extensive part in benzoic compounds, if it be not this hydrogenated substance, (s'il n'est cet hydrogéni,) which itself gives rise to a series of new compounds, several of which are described in the memoir.

4th. That retinyle is a new sesquicarburet of hydrogen, which may be represented by the formula $C^9 H^6$ or ($C^{36} A^{24}$,) susceptible also of being transformed by chlorine, bromine, nitric acid, &c., into compounds which also present a series of new combinations.

5th. That retinole is a new bicarburet of hydrogen, of the formula $C^{16} H^8$ or ($C^{64} H^{32}$,) different from the bicarburet of hydrogen $C^6 H^3$ of Faraday, both in constitution and chemical properties.

6th. That metanaphtaline is a new substance, different from naphtaline in its properties, but isomeric with it in composition; a substance remarkable for its beauty, and its chemical inertness, a property which assimilates it to paraffine, but from which it totally differs in physical properties and composition.

In this memoir we have shown the nature, properties and composition of

the substances which result from a red heat applied rapidly and in a manner instantaneously, to resin. In a second, we propose to examine the products arising from resin at lower temperatures.

Recurring to the present results, we shall inquire into the action of heat more or less suddenly applied to our products, to ascertain whether they pass into each other. We may thereby learn some facts which may serve at a future period to establish the theory of *pyrogenous products*,—a theory which latterly has made such great progress in the hands of two of our ablest chemists; but which it would be very unreasonable, in our opinion, to regard as definitively settled. Ann. de Chimie, et de Physique.

Ferment, or Yeast, its Nature.

This substance has recently claimed the attention of several chemists, who have examined its properties, the manner in which it is affected by various agents, and the changes it produces on them.

M. Cagnard-Latour (Comptes rendus de l'Institut, 1837, page 906,) thus sums up the results detailed in his memoir:—

1st. The yeast or leaven of beer is a mass of small globular bodies, capable of self-reproduction, and of course oxygenized, and not an inert or purely chemical substance, as has been supposed.

2d. These bodies appear to belong to the vegetable kingdom, and are generated in two different modes.

3d. They appear to act upon a solution of sugar as if they were alive, whence it may be inferred, that it is in all probability by some effect of their vegetation that they disengage carbonic acid from this solution, and thus convert it into a spirituous liquor.

I will further observe, adds Cagnard-Latour, that yeast, considered as an organized substance, deserves perhaps the attention of physiologists as such; for

1st. It springs forth and developes itself, in certain circumstances, with great rapidity, even in the midst of carbonic acid, as in a brewer's vat.

2d. That its mode of regeneration presents peculiarities of a kind which have not been observed with respect to other microscopic products, composed of isolated globules.

3d. And that it does not perish by a great privation of heat or of water.

M. Desmazieres, as long ago as 1826, describes and figures the globules of yeast, with so much precision as to require but slight modifications to render them equal to what is now known, but it is very extraordinary that he seems never to have suspected the part which these globules act in the process of fermentation.

In a valuable memoir by T. A. Quevenne on this interesting subject, (Jour. de Pharm., Juilliet, 1838,) the author arrives at the following conclusions:—

1st. Yeast is a substance which constantly presents the appearance of little globules of nearly uniform figures.

2. These globules appear to be always of the same nature, whatever their origin.

3d. It is the insoluble constituent part of these globules which is apt to produce fermentation, and not the extractive matters which accompany it.

4th. The globules of yeast can effect the decomposition of sugar not only at a temperature from 10° to 30° or 40° Cent., but even at the heat of

boiling water; but, with this difference, that at a temperature inferior to 50° they transform the sugar into alcohol and carbonic acid, while above 50° (= 122 F.) alcohol appears not to be formed;—the only gas obtained in either case is carbonic acid.

5th. Yeast, during the alcoholization of sugar, undergoes a thorough modification. It loses all its azote, which goes to form ammonia, by which means its fermentative power is completely exhausted.

6th. The globular aspect of yeast, and its principal chemical properties, are sufficient to induce us to regard it as an organic substance of new formation; and hence fermentation ought not to be considered merely as a decomposition, but simply as a modification which gives birth at one and the same time to products both organic and inorganic.

7th. The circumstances under which fermentation takes place, and the phenomena which accompany it, and the influence which a great number of bodies have over the progress of the operation, are of a nature to induce the belief that it is actually owing to a sort of vegetation; but this proposition, before it is definitively admitted, appears to me to require additional proof.

Jour. de Pharm.

Simple method of depriving the common Oil of Petroleum completely of its color, without distillation. By Böttger.

Add to two pounds of common oil of petroleum, in a glass vessel, from four to six ounces of fuming sulphuric acid. Shake the mixture several times a day during several days. In about a week the oil will be colorless, and all organic matters which it contained will have been carbonized by the sulphuric acid.

Open the bottle, and taking care to avoid the sulphurous acid gas which rapidly escapes, draw off, by a syphon, the oil into another bottle, add some water and shake it well, renewing the water several times. Let it remain at rest for some time, and then draw it off into a third bottle into which about three ounces of caustic lime, in fragments, has been put. Shake it again repeatedly, and then let it remain at rest for some time. The oil purified by this method is perfectly colorless, and very fit for the preservation of sodium and potassium, which will remain for years in it without oxidation.

This method was tried by F. Möhr, and succeeded perfectly. A. G. V.

Idem.

Filtering Apparatus.

The method of Fonvielle (V. Jour. Frank. Insti., vol. xxii,) continues to operate in the most satisfactory manner. On the 2d of June last a large assembly of high municipal and other functionaries, with many savans and other citizens, attended at the pump of Notre-Dame to witness the operation of the filtering machine. A single box, gauged in the presence of the audience, and whose capacity did not exceed one metre by two, operating under a pressure of 45 feet head, yielded, per minute, 280 litres (= 74 galls.,) of filtered water, or 106,560 gallons per day. An apparatus on the old construction, would yield only about the eight hundredth part of this quantity.

The facility with which these filters clean themselves, interested the company very highly. It is this indeed which gives the highest additional value to this important invention. To witness the extreme filthi-

ness of the water driven from the apparatus by the shock of the two opposite currents, and this in a few moments after succeeded by perfectly limpid water, gave universal satisfaction.

The filtered water, though issuing from the filtering box situated in the lower part of the building, is, by an arrangement now first introduced by the company, made to ascend, by hydrostatic power, to a height nearly equal to that of the head, and thus, at pleasure, it can be distributed to all parts of the edifice where it may be wanted. Rec. de la Soc. Polytechnique.

Method of Perforating Glass. By M. Albrecht.

Put a drop of spirits of turpentine on the place where the hole is to be made, and in the middle of this drop a small piece of camphor. The hole can then be made without difficulty by means of a well tempered borer or a triangular file. Solid turpentine answers as well as a mixture of the oil or spirit and camphor. Annales des Mines.

Researches on Filtering Paper. By Werdemiller de Elgg.

The filtering paper I use in my laboratory, leaves by combustion, 0.006535 of ashes, composed of

Sand	0.0225
Silica	0.2868
Alumine	0.1222
Peroxide of Iron	0.0781
Lime	0.3421
Magnesia	1.1511
	1.0028

After being long digested in dilute muriatic acid, it leaves only 0.00171 of ashes consisting of pure silica. Treated, on the contrary, with caustic potash and then well washed, it leaves 0.00477 of ashes. Finally, treated alternately by acid and caustic alkali, it gives only 0.0005 of ashes, consisting for the most part of small grains of quartz.

When I have to weigh a precipitate collected on a filter, I proceed as follows:

I dry a filter, with the greatest care, weigh it, and preserve it wrapped up in a sheet of paper to preserve it effectually from dust. Then when I wish to weigh a common filter, I do not take the trouble to dry it, which is a tedious process, but I weigh it as it is, and then weigh my specimen filter; calculate the quantity of hygrometric water the latter has absorbed, and from these data determine what would be the weight of the filter to be employed, if perfectly dry. Ibid.

On some Phenomena of Coloration. By M. Suckow.

A bundle of four cotton wicks of equal size, moistened, one with an alcoholic solution of chloride of calcium, the second with a solution of chloride of strontian, the third with a solution of chloride of copper, and the fourth with a solution of chloride of cobalt, burns with a flame which has the same color as that of common alcohol.

A pearl of phosphate of soda, feebly colored by oxide of manganese, be-

comes colorless and transparent by the addition of a very small quantity of oxide of copper.

A pearl of the same fusion, colored yellow by the oxide of uranium, becomes colorless and transparent by the addition of a very small quantity of oxide of manganese.

A pearl of borax, colored pale blue by oxide of cobalt, becomes colorless and transparent by the addition of a small quantity of tartaric acid.

A crystal of tourmaline, one side of which was a violet red and the other colorless, was found to contain protoxide of manganese in all its parts, while the colorless portion alone contained, in addition, protoxide of iron. Ibid.

On the Condensation of Chlorine. By M. Mohr.

Melt some bisulphate of potash, pulverize it and mix it intimately with chloride of sodium and peroxide of manganese. Fill, with the mixture, three-fourths of the long branch of a very strong glass tube; press on the mixture chloride of calcium to the depth of about two inches, then close the other extremity of the tube hermetically by the lamp. Introduce this tube into a gun barrel, with sand, and heat it in a furnace adapted to organic analysis. There is soon condensed in the short branch of the tube a considerable quantity of chlorine, perfectly dry, characterized by its orange yellow color, without any shade of green. Ibid.

On the Theory of Acetification. By M. Liebig.

The process now employed in making vinegar consists in bringing into contact with atmospheric air at a temperature of 82° to 86° cent. weak alcohol, which is spread over an extensive surface by mechanical means. Under these circumstances, and by aid of the presence of a very small quantity of organic matter, (sugar, malt, &c.,) whose action has not been sufficiently studied, the alcohol is transformed into acetic acid.

The composition of alcohol is expressed by the formula $C^4 H^{10} O + Aq.$—that of acetic acid by $C^4 H^6 O^3 + Aq.$—the latter contains 4 atoms of hydrogen less and 2 atoms of oxygen more than alcohol. The subtraction of the hydrogen is effected by the oxygen of the air; 2 atoms of this gas carry off four atoms of hydrogen, and 2 other atoms unite with what remains to form acetic acid. At first *aldehyde* is produced $C^4 H^6 O + Aq.$, and the latter, in contact with the air, is oxidized with extraordinary rapidity and changed into acetic acid.

One hundred parts of alcohol take from the air 69 parts of oxygen, and make 169 parts of acetic acid, one ounce of which saturates 424 grains of carbonate of potash. With a suitable use of *mother* of vinegar, we may obtain from 63 measures of brandy having 0.150 of alcohol, 560 measures of vinegar, of which one ounce will saturate 30 grains of carbonate of potash, and there is lost $\frac{1}{13}$ of acid.

To obtain a maximum of production in the fabrication of vinegar, it is necessary to establish in the building a current of air from bottom to top, so as to furnish sufficient oxygen for the alcohol to absorb.

When there is a deficiency of air, the acetification goes on slowly and with actual loss, because a part of the aldehyde, first formed, passes off in vapor, by its great volatility, (it boils at 22° cent.,) and is not converted into

acid. In fact, by distilling a spiritous liquor incompletely changed to vinegar, a colorless fluid is obtained, in which aldehyde may be detected.

We may be certified of the presence of this substance in two ways: 1st. By heating the liquor with a solution of caustic potash, when it becomes of a wine color, yellow, brownish yellow, brown, and deep brown, according to the proportion of aldehyde. 2d. In heating it with nitrate of silver with the addition of a little ammonia;—the sides of the vessel become coated as with a polished surface of pure metallic silver. The first test is certain, and preferable to the second. Ibid.

Observations on Cane Sugar, and on a new Acid formed by the action of Alkalies on the Sugar of Starch. By M. Peligot.

It is well known that there are two distinct varieties of sugar, namely, common sugar extracted from the cane, from beets and from the maple;—and the sugar of grapes, which is also found in diabetic urine, and is likewise produced when starch, woody fibre, or sugar of milk is placed in contact with dilute sulphuric acid.

Common sugar combines with bases without undergoing any modification; for in decomposing the saccharates by weak acids, the sugar is reproduced with all its characteristic properties. It is quite otherwise with starch sugar. The alkalies and alkaline earths transform it even in the cold, into a powerful acid, which completely neutralizes bases, and which can be extracted from the insoluble combination which it forms with the oxide of lead, and into another non-volatile substance, which possesses the property of reducing immediately the salts of mercury and silver without heat. Ibid.

Elementary Composition of the Starch of various Plants; of its most concrete portions, of those most easily disintegrated, of the products of its dissolution, and the atomic weight of Starch and Dextrine. By M. Payen.

It is known that under the influence of acids, of diastase, and even by the application of heat alone, starch is converted into a gummy product called *dextrine.* Dextrine may be obtained in combination with the oxide of lead in two proportions. The basic dextrinate is procured by pouring a solution of dextrine into acetate of lead mixed with ammonia, and the neutral dextrinate by pouring acetate of lead into a boiling hot solution of ammoniacal dextrine. The two salts dried, at 100° C., contain an atom of water, which they lose at 180°. The dextrine of the dried salts is anhydrous. Its formula is $C^{24}\ H^{18}\ O^{9}$. Dextrine, in a free state, dried at 120° contains one atom of water, and dried at the common temperature it contains two atoms.

Starch has exactly the same composition and the same atomic weight as dextrine. Dried at the temperature of 130°, its formula is $C^{24}\ H^{18}\ O^{9}$, $H^{2}\ O$. Exposed to the air, dry or moist, it re-combines with different portions of water, and in its combination with the oxide of lead, heated to 100° it becomes $C^{24}\ H^{18}\ O^{9}$.

Dextrine differs from starch only in not forming a blue compound with iodine, as starch does. It appears to be nothing more than starch brought to a state of extreme division. Starch is an organic substance organized. Whatever its origin, it has always the same composition. Rubbed with

cold water, it is divided into products differing by their aggregation, but identical in their fundamental properties. Ibid.

New Method of Working Caoutchouc.

The employment of ether, spirits of turpentine, the volatile oil of caoutchouc, balsam of copaiva, and the oils obtained from gas works, as solvents of India Rubber, have the disadvantage of being expensive, and of producing a varnish which dries with much difficulty. For some time past ammonia has been used with advantage. The gum elastic, cut up into shreds, is covered with caustic ammonia and left in this state several months. The ammonia becomes brown, and the gum assumes a brilliant and silky appearance, resembling a fresh nerve. The caoutchouc swells, but is still elastic, and resembles very closely, beautiful silky threads, when drawn out, but it breaks more easily than raw caoutchouc.

In treating this swelled caoutchouc with spirits of turpentine, it is easily converted, by agitation, into an emulsion, and in a short time it swims on the surface like butter on milk; after this it acts like varnish. But a much smaller quantity of spirits of turpentine is sufficient to dissolve it than when it has not been softened by ammonia. Ibid.

On the use of Chromate of Lead in the Analysis of Organic Bodies. By M. Richardson.

This salt is prepared by precipitating a salt of lead by bichromate of potash. Heat it till it melts and then pulverize it. As it attracts no moisture from the air, it is preferable to the oxide of copper in organic analyses, for it is only necessary to keep it for a while in a warm place. The mixture must be thorough, because, for tubes of equal length, a greater quantity of the organic substance must be exposed to heat than when oxide of copper is used, on account of the great quantity of oxygen contained in the chromate of lead. Tubes for analyses ought to be about ten inches long and four-tenths of an inch in diameter.

Chromate of lead allows of a larger quantity of a substance to be subjected to analysis than oxide of copper, on account of its greater density. During the whole of the combustion, oxygen is discharged from the end of the tube containing the potash, because the chromate has a great tendency to pass to the condition of a basic salt. This circumstance, and especially the quantity of oxygen in this salt, might render it very useful in the burning of bodies which contain much carbon. This chromate furnishes also an excellent method of analysing compounds which contain chlorine, bromine, &c., because the chlorites, bromites, &c. of lead, are not volatile. Idem.

Crystals of Insoluble Substances formed Artificially. By M. Gaudin.

Microscopic crystals of a perfect form may be obtained by placing certain solutions in an artificial atmosphere; by placing, for example, a capsule containing moistened carbonate of ammonia under the same bell glass with a vessel holding a weak solution of a salt of lime, barytes, lead, &c.—or preferably, by putting into a tube, of the length of the finger, a saline solution, and over it, in the upper part of the tube, before closing it, cotton moistened with the substance intended to form the atmosphere.

To obtain crystals composed of elements scarcely or not at all volatile, we may have recourse to stratagem. Sulphate of barytes, for instance, may be formed by placing under the same glass, a vessel of fuming hydrochloric acid, and a foot glass holding water, sulphate of lime, and carbonate of barytes.

A solution of a salt of pure lime generally affords crystals under the form of primitive rhombohedrons with their principal modifications, while solutions of arragonite furnish simultaneously crystals of the form of iceland spar, and other crystals of the form of carbonate of barytes. Idem.

On the Employment of Metallic Sulphurets, prepared in the moist way, in Chemical Analysis. By M. ANTHON.

Certain oxides, as is well known, have the property of precipitating others from their solutions. The metallic sulphurets prepared in the moist way, produce the same effect: the precipitated oxide is then transformed into a sulphuret, while the metal of the sulphuret combines, in the state of oxide, with the acid of the dissolved salt.

It results from the experiments that I have made with regard to silver, copper, lead, calcium, iron, nickel, cobalt and manganese, that when these metals are arranged in the above order, the sulphuret of one of them precipitates the solutions of all the metals which precede it, and occasions, on the contrary, no change in the solutions of the metals which follow. Thus the sulphuret of nickel precipitates the salts of silver, copper, lead, cadmium, and iron, and does not affect the solutions of cobalt and manganese.

There is one exception, however, and only one: the sulphuret of iron precipitates nitrate of lead, while the hydrochlorate and nitrate of the peroxide of iron are partially precipitated by the sulphuret of lead. Idem.

On the Preparation of some Amalgams. By BÖTTGER.

I have succeeded in preparing a certain number of amalgams which hitherto had resisted my efforts. For this purpose I decompose the metallic chlorides by an amalgam of sodium. Hydrogen is disengaged, a hydrated metallic oxide is abundantly precipitated, and the mercury, which was united with the sodium, is now found allied with a certain quantity of the metal. The amalgams I have prepared by this process are those of nickel, cobalt, manganese and iridium.

The amalgams of nickel and cobalt have but little consistency; they do not act upon the magnetic needle, but the action becomes sensible when they are heated so as to expel a portion of the mercury. When the mercury is all volatilized by heat, a black very magnetic mass remains, composed of metal and oxide. The amalgam of manganese is much thicker—it is strongly charged with manganese, and it decomposes water slowly. The amalgam of iridium is prepared by decomposing a solution of the double chloride of iridium and sodium by the amalgam of sodium. This amalgam is thick enough; heat separates from it metallic iridium.

I have tried the same reaction on concentrated solutions of the chlorides of tellurium, aluminium, cerium, calcium, and nitrate of uranium, but have not succeeded in obtaining amalgams. Idem.

Physical Science.

Description and Use of a Dipping Needle Deflector, invented by Robert Were Fox, Esq. *By* Mr. T. B. Jordan, *Philosophical Instrument Maker, Falmouth.*

The data for the accompanying paper having been kindly furnished by Mr. Fox, I now have the pleasure of forwarding it for insertion in your valuable Annals, in connexion with the description of the instrument which I have already sent you. T. B. Jordan.

Description of the Instrument.

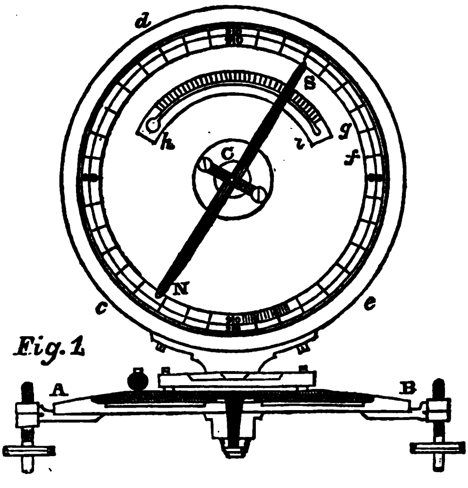


Fig. 1

Figs. 1 and 2 are front and back elevations of the instrument, and fig. 3, a transverse section with the deflectors screwed in. The same letters of reference are used in each figure. A, B, is the azimuth plate on which the vernier plate turns either in the same plane or with the usual beveled edge, as in theodolites. In the best instruments this limb is divided on silver or platina, and is read off by two verniers. The vernier plate is furnished with two levels, and the leveling screws are fixed to the foundation plate,

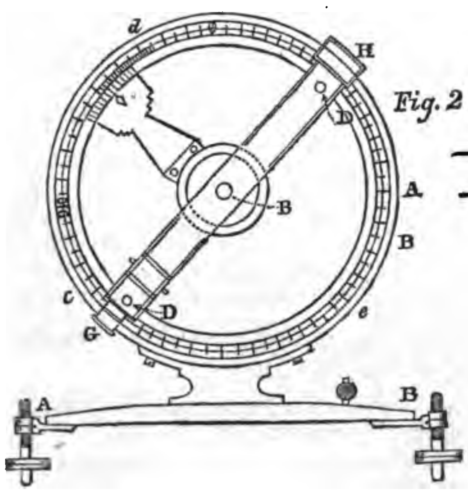


Fig. 2

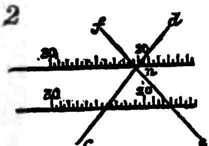
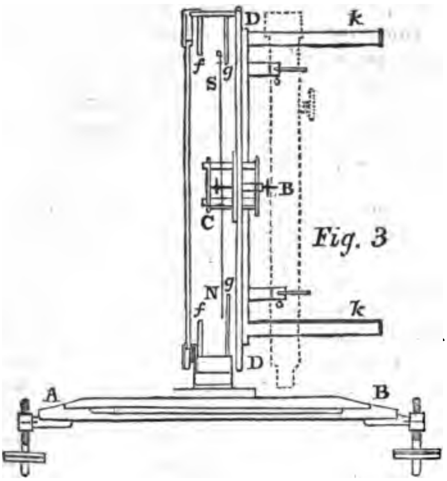


Fig. 2'



as in the figures; or the instrument is made to screw on a stand similar to that used for field theodolites. *c*, *d*, *e*, is a circular brass box containing the needle N, S, two graduated circles *f*, *g*, and a thermometer *h*, *i*. The axis of the needle is terminated by exceedingly fine and short cylindrical pivots which work in jewelled holes. It may readily be removed from its bearings by releasing the screw B, at the back of the instrument, which admits of the front jewel coming forward sufficiently to remove the needle. The small grooved wheel C, on the axis, is intended to receive a thread of unspun silk, furnished with hooks for hanging the weights on in taking intensity observations, and the thermometer *h*, *i*, is intended to note the temperature at the same time.

The graduated circles, *f* and *g*, are adjusted to a perfect coincidence: the front one serves to direct the line of vision, and answers the purpose of a vernier.

At the back of the instrument (Fig. 2) there is another graduated circle adjusted to coincide with those in the box: but the zeros are generally placed on the vertical instead of the horizontal line, for the convenience of having the vernier arm independent of those carrying the deflectors.

The deflectors, *k*, *k'*, fig, 3, are two small cylindrical magnets, having their poles terminated by cones. After being magnetized and reduced to a standard intensity by heat, they are carefully packed in brass tubes; the outer tube of each is furnished with a screw, by which it can be fixed to the arms, D or D', at pleasure.

G, H, fig. 2, is an acromatic telescope fitted with webs, similar to a transit. Its use is to determine the true meridian for the variation of the needle; but as it has a vertical movement about the centre of the needle box, and a horizontal one on the vertical axis of the instrument, of course it may be used for measuring angles in either direction. It may be removed from its Ys when not in use.

The whole instrument is packed in a neat mahogany case, with magnetic armature, arranged so as to preserve the power of the different magnets. In addition to the parts described, the box contains a set of decimal weights for intensities, a pair of plyers, a rubber for producing friction on the back screw or pin, a screw driver, &c. &c.

The dotted lines in fig. 3 show the place of the telescope when in use.

Use of the Instrument.

Reading off, by means of two parallel graduated Circles.

The graduations on the parallel circles being coincident, they serve to direct the line of sight, and to prevent parallax in determining the position of the needle.

This arrangement also answers the purpose of a *vernier:* thus suppose the outer graduated circle to be *fifteen times* further from the points of the needle than the inner circle, the lines of sight, of which the points of the needle form the respective pivots, must pass over *fifteen* divisions on the former, to cause the needle to appear to pass over *one* equal division on the latter. If the relative distances of the two graduated surfaces from the points of the needle are unknown, it is evident that they may be readily ascertained by the same method.

To make this more clear, let the lines, A, B, fig. 2′, represent portions of parallel circles divided to half degrees; *n*, the point of the needle, and *c*, *d*, and *e*, *f*, visual rays; then by inspection of the figure, it becomes evident that the eye must, in passing from *c* to *e*, run over fifteen divisions on the outer circle before it can make the point *n*, appear to pass over one on the inner circle, so that the value of each division on the outer circle is two minutes, or of each degree four minutes. In reading off an instrument with this adjustment, we first observe the division which the needle has passed, (in the figure this is 21°) and then carry the eye on until we find some division which will fall in the same line with it and the needle point; in the figure this line is *c*, *d*, and the number of divisions passed over from 21° is 7, or 3° 30′, which makes the reading 21° 14′.

To find the magnetic declination.

Level the instrument by means of its screws, and ascertain the true meridian by the telescope, or sights, at the back, as the case may be, these being parallel to the plane of the needle, and note the angle indicated by the vernier on the horizontal limb. Turn the box round till the needle stands perfectly vertical, gentle friction* having been several times employed to cause the needle to take its true position.

The friction is produced by an ivory, or brass, surface being rubbed against the extremity of a pin which projects from the back of the extremity of the jewel plate, and again note the angle on the horizontal limb. The face of the instrument should then be turned round to the opposite quarter till the needle again becomes vertical, and if it required more, or less, than 180° to effect this, half the difference will indicate the true magnetic meridian, the face of the instrument being at right angles to it.

To ascertain the dip.

The face of the instrument having been made to coincide with the plane of the magnetic meridian, by turning it 90° from its last position, and vibration produced as before, the mean indications of both poles of the needle should be carefully observed and noted. The face should then be turned round 180°, so as to be again in the plane of the magnetic meridian, and the observations repeated and noted; the mean of the whole will indicate the dip.

To correct the observed dip.

The instrument being still in the plane of the magnetic meridian, screw on the deflectors, *k*, *k*, at right angles from the back, as shown in figure 3, so as to *repel* the ends of the needle which are nearest to them: adjust the deflectors at a given angle from the supposed or observed dip, say at 45° or at 50° from it, as shown by the vernier or verniers at the back.

Suppose after vibration, that the lower end of the needle settles at 115°

* This must in no case be omitted previous to reading off the place of the needle.

from the o on the north side of the instrument. Then turn the deflectors back to an equal angle from the observed dip, say 45°, or 50° as the case may be, on the opposite side of it, which suppose to be 69° 20′, and that the poles of the needle stand at 23° 30′. Then 23° 30′ + 115° = 138° 30′, which divided by 2, gives 69° 15′. Turn the instrument round 180° in azimuth and repeat the process, and if the result should be 69° 13′ the mean or corrected dip will be 69° 14′. Similar observations may be multiplied at pleasure by varying the angles of the deflectors from the observed dip, but generally three sets of observations will be perfectly satisfactory.

Mr. Fox generally employs one deflector to ascertain the true dip, as small angles seem often to give more uniform results than large ones. The following may be considered as fair specimens of the results obtained by this method, even with a four inch needle.* They were recently observed at Westbourne Green, Paddington, near London, by Mr. Fox, in company with Capt. Ross, R. N.

The deflector which repelled the north end of the needle having been screwed into the lower arm at the back, and adjusted at 40° from the apparent dip of 69° 20′ first on one side and then on the other.

First Observation.

Instrument facing East needle repelled to	87°	10′		
On altering the deflector to 40° on the other side, needle stood at	51	20		
Sum	138	30;	which ÷2=69° 15′	Mean 69° 17′ .5
Facing west needle repelled to	86°	58′		
And afterwards to	51	42		
Sum	138	40;	which ÷2=69° 20′	

Second Observation

Deflector adjusted at 50° from apparent dip of 69° 20′ facing east	85°	20′		
And afterwards	53	8		
Sum	138	28;	which ÷2=69° 14′	Mean 69° 16′ .5
Facing west	85°	2′		
And afterwards	53	36		
Sum	138	38;	which ÷2=69° 19′	
General Mean,	.	.	. .	69° 17′

If the apparent dip had been taken at 69° 14′ or 69° 15′, the corrected dip would probably have been reduced to 69° 16′ or 1′ less, an original error of 5′ or 6′ in the apparent dip being reduced to 1′ by this method of correction. It may here be observed, that in this way the bearings of the

* Satisfactory as these observations are, a longer and heavier needle is found to give still more uniform and consistent results.

axle of the needle are changed, and by turning the jewel plate the resting places in the jewels are also changed, and under all these circumstances the results have been found most satisfactorily and remarkably uniform.

To ascertain the terrestrial magnetic intensity by means of weights.

Take off the deflector or deflectors and place the fine silk, with the hooks attached, on the grooved wheel, and suspend weights to one of the hooks so as to coerce the needle to a given distance, say 50°, from the actual dip at the station; and after applying friction as usual at the back, note the weights required; then change the weights to the other hook till the needle is coerced 50° on the opposite side. The weights required will indicate the magnetic intensity at the place of observation as compared with that ascertained in the same manner at any other place. Instead of having *given angles* to which the needle is to be deflected, it is more easy and practical to employ *given weights*, and the inverse ratio of the sines of the angles of deflection will give the intensity; corrections having been applied for differences of temperature at the different stations.

Mr. Fox has lately obtained many results of intensity, as well as of dip, at various places on the continent and in this country, with a small portable dipping needle deflector, having a 4-inch needle; and on this needle 1° of the Centigrade scale produces an effect on the angles of deflection equal to 2′ to 2′. 4. An example will show the method pursued.

Suppose two grains to be the given weight employed in one of his experiments, the instrument facing east, and that the needle counting from 0° was stationary at . . . 118° 8′ and afterwards on putting the 2 grains on the other hook at 20° 40′

Included angle	97 28; which ÷ 2	= 48° 44′
The same observations repeated facing west	.	= 48 38
Mean, instrument facing east and west		48 41
Temperature 17° centigrade, or taking 14° as the the standard, there would be 3° in excess, for which deduct		0 7
Corrected mean angle . .		48 34

the inverse ratio of the sine of which will show the intensity in relation to other results similarly made, and with the same weights.

Similar experiments may be made with other given weights, 2.1 grs., 2.2 grs., 2.3 grs., &c. for instance, and the number of observations multiplied at pleasure, and the mean of the whole taken.

The following are a few of the results which Mr. Fox has obtained, which may serve to show the working of the method in question. The needle used was only 4 inches long, and, consequently, did not give such uniform results as a larger needle would have done.

Mean results obtained at different stations near London.

Corrected angle, the instrument facing east and west.

Grs.		Intensity.
2.0	= 48° 36′ .7	= 1.0000
2.1	= 51 55 .3	= 1.0000
2.2	= 55 33 .0	= 1.0000

Eastbourne, in Sussex, Grounds of Davies Gilbert, Esq.

(Chalk.)

Grs.				Intensity.
2·0	=	48° 57′	=	0.9938
2·1	=	52 19	=	0·9921
2.2	=	55 57	=	0·9952
		Mean		0·9937

Eastwick Park, near Leatherhead, Grounds of David Barclay, Esq.

(Chalk.)

Grs.				Intensity.
2·0	=	48° 35′	=	0·9997
2.1	=	51 57	=	0·9996
2.2	=	55 40	=	0·9986
		Mean		0·9993

Grounds of Combe House, near Bristol, George Hilhouse, Esq.

(Limestone.)

Grs.				Intensity.
2·0	=	48° 25′	=	1·0023
2·1	=	51 45	=	1·0024
2·2	=	55 18	=	1·0031
		Mean		1·0026

Grounds of R. W. Fox, Esq., near Falmouth.

(Clay Slate.)

Grs.				Intensity.
2.0	=	48° 29′	=	1.0013
2.1	=	51 48	=	1.0017
2.2	=	55 20	=	1.0026
		Mean		1.0018

The intensity of the earth's magnetism may also be ascertained by means of the deflectors. For this purpose the latter should be screwed into the sockets in the arms at the back of the instrument, and adjusted to the dip at the station, so as to repel the needle from it, first on one side and then on the other.* Half the sum of the included angles will represent the force of the earth's magnetism in relation to that of the deflectors on a needle thus circumstanced; that is, at the angles which the latter makes with them respectively. The value of the sines of angles thus taken at different stations and with the instrument facing east and west, may be ascertained by means of small weights. For this purpose the deflectors should be placed *at the angle* of which the value is to be ascertained, the same to be calculated from *the actual dip at the place of observation where the weights are to be employed.* The weights required to coerce the needle back to the dip, against the force of the deflectors, will give that of the earth's magnetism on the needle, at the angle, the value of which is required, and in comparing the value of

* The position of the needle may be readily changed from one side of the dip to the other, by turning the jewel plate and its bracket by means of the knobs at the back.

different angles the sines of which will be greater or less in proportion as the terrestrial magnetic intensity is less or more, corrections must be applied according to the sines of such angles in an inverse ratio. Such observations, in order to be quite satisfactory, should be made with the deflectors adjusted on each side of the dip, and, when convenient, with the instrument facing the east and west, the mean of the whole being taken. Upon the whole, however, Mr. Fox prefers using the weights alone for ascertaining the intensity, if time should not admit of both methods being employed, which he finds they will do with a remarkable degree of uniformity and precision. It may here be observed, that if the needle should have sustained any diminution of force, it will settle at a *less* angle from the deflectors when in the dip at a given station, and at a *greater* angle when deflected by given weights only; whereas, if the force of the earth's magnetism should only be diminished by a change of station, the angles will be increased by both methods.

It is evident that if the deflectors are fixed at a constant angle from the dip, *at any given station*, and the needle is coerced, as before, into the line of dip, the weights required will be constant if no change has taken place in the magnetism of the deflectors, or the needle; and they will detect the amount of such change should it occur at any time or place.

In order to ascertain whether or not the needle itself has varied in intensity, remove the deflectors and screw the tube containing the second needle, which call number 2, into one of the arms at the back, so as for it to repel the suspended needle number 1. Adjust number 2 at any given angle, suppose 45° from the line of dip at the station, and coerce number 1 by weights into the dip. Repeat the operation with the opposite end of number 2, or rather screw the tube into the other socket. Half the sum of the weights required in both cases will indicate the repulsive forces of the needles with respect to each other under these circumstances at the angle of 45°. Remove number 2 from the back, and deflect number 1 to any given angle, say 45° from the dip, by means of weights only, and note the weight required to effect this. Change the needles, placing number 1 in the tube, and suspending number 2, and go through precisely the same operations as before. If, under these circumstances, there should appear to be any difference from the previous results in the reciprocal action of the needles, take the mean of both.

It is highly desirable that the deflections should always be made on *both sides* of the line of dip to ensure accuracy, and the process will be still more complete if done with the instrument facing both east and west.

In this manner the reciprocal force of the needles on each other may be ascertained, and their respective forces in relation to that of the earth's magnetism, under the circumstances described; and, therefore, approximately at least, the influence of any change in the former in relation to the latter, and vice versa.

These relations may be ascertained by experiments and varying the force of the needles at a given station where the terrestrial magnetic intensity is, for the time of their duration at least, presumed to be constant. And it can scarcely be doubted that this method furnishes the means of obtaining a true standard measure of the force of the earth's magnetism, at any time or place on given needles; or at least of approximating very closely to it.

In the course of such experiments it may, moreover, be found desirable to adjust the deflecting needle parallel to the arms at the back, (for which provision is made in the large instruments) and under such circumstances to repeat the operations which have already been described, with the deflect-

ing needle at right angles to the arms; and in both cases the given angles may be multiplied at pleasure; thus 40° and 50° may be taken as well as 45°, and the deflecting needle may be likewise fixed in the line of dip so as to repel the suspended needle from it, instead of using the weights alone for this purpose, and in this way the relation of the needles with respect to the earth's magnetism, may be ascertained by applying the weights as described in the case of deflectors.

It will not be requisite, at any time, to employ extremely minute weights; as the value of small difference in the angles may easily be estimated in weights; thus if $\frac{1}{30}$ of a grain should cause the needle, under given circumstances, to pass through 30′ $\frac{1}{300}$ of a grain, will be represented by 3′.

In all observations on the magnetic intensity, the temperature should be noted, and the needful corrections applied, the amount of which may be readily ascertained by experiments, such as covering the instrument with a heated vessel inverted, or admitting heated air under it, &c. In one instrument, a needle, when deflected by weights 50° from the dip, had the angle increased more than one minute, by every degree (Fah.) of augmented temperature: in other needles of weaker intensity, the influence of temperature has been less considerable; the *ratio* appears to be nearly uniform within the ordinary range of changes in this climate.

If the needles are tempered very hard throughout, and, after having been magnetised, heated to 180° or 200°, Mr. Fox has found that they sometimes retain their force without any appreciable change for a long period of time, although he has continually observed that the magnetic axis* of a given needle, is liable to frequent variation, even without its having been retouched.

This is shown by its having at one time uniformly an excess of dip, when facing east for instance, and at another, when facing west, and this without affecting the mean results on either occasion. He also finds that needles attain their maximum force after having been rubbed by a magnet or magnets two or three times only.

Annals Electricity.

Notices from the French Journals, translated for the Journal of the Franklin Institute, by J. Griscom.

Turbines.

M. Savary read a report (to the Academy of Sciences, Paris,) in his own name, and those of M. M. Prony, Arago and Gambey, on a memoir of M. Morin, containing the result of experiments on the turbines of M. Fourneyron.

Under the general name of turbines is understood water wheels which have scarcely any thing more in common than that of turning on a vertical axis. Those which an engineer, M. Bardin, invented and first made known under this appellation, receive the water at the top of a vertical cylinder or drum, and discharge it at the bottom. The water enters and issues near the circumference, and runs along spiral channels bent round the surface of the drum, which must be half as high as the whole disposable fall of the water.

* This fact suggests the expediency of having the wide part of a horizontal variation needle vertical and not horizontal, to ensure the greatest degree of uniformity in its indications.

In the turbines of M. Fourneyron, the drum is never very thick, a foot or so, for example. The water rushes obliquely in horizontal jets round the contour of an internal vertical cylinder, and enters all the compartments of the wheel, which, in its revolutions, just clears this cylinder, presses upon the curvilinear buckets which lie between the horizontal bases, and escapes horizontally by a vertical aperture in the exterior drum.

We may form an idea of the turbines of M. Fourneyron by supposing a common wheel with curved pallets to lie flat, and that the water, entering the pallets in the centre, issues at the circumference.

M. Poncelet proposed, in 1826, an arrangement the reverse of that now mentioned—the water entering at the circumference and passing off at the centre. It will be sufficient to state, that the experiments of M. Morin on the turbines of M. Fourneyron, lead to the conclusion that they are, at least, as advantageous as the best wheels of the ordinary kind;—in fact, under falls which varied from the weak value of 1 foot to those of 1, 2, 3, and 7 or 8 yards, the disposable work of the turbines amounted to 7 or 8 tenths of the motive power. This is the effect absolute. With regard to the variable circumstances under which a hydraulic mover may be placed for useful purposes, the reporter states that the turbines present some special advantages. They are, he says, in reality, of all kinds of hydraulic wheels, those which, under the least bulk, are available with the smallest quantity of water. The water which propels them does not press upon the axles. The immense velocities, and the variable velocities which they are allowed to take without sacrificing any thing of their effect, admits, in many factories, of the suppression of the wheel work and the heavy axles which are designed to transmit, with accelerated motion, the slow movement of the great bucket wheel.

Another property of the turbines is still more important. M. Morin, as well as other engineers, observes that they operate as well when immersed, (noyées) as when out of water. Perhaps it would be as well to admit, in such a case, of a slight difference.

At more than the depth of a yard under water, the liquid sheet escapes from the buckets with as much facility as at the surface. The action depends only on the difference of level between the upper and lower part of the current, and not upon the absolute height of either. This is a most valuable property of the new wheels, as it renders the entire fall of water available under all circumstances. L'Institut.

Saturn's Ring—A new Subdivision.

It is known that the ring of Saturn is composed of two concentric rings separated by an empty space, which presents the appearance of a dark line, visible only by powerful glasses. Short imagined that he had seen a greater number of subdivisions in the ring, and some modern observers have confirmed this assertion.

M. Encke made, last spring, some new observations on this celestial object with the great achromatic telescope of 9 inches aperture and 15 feet focal length, belonging to the Observatory of Berlin. The result he thus communicated to M. Schumaker.

On the night of April 25th, 1837, which was very clear, I tried, upon Saturn, a new achromatic ocular of the mechanician Duwe, of Berlin, with a power of 600, and a field of more than 6 minutes, in the whole extent of which the image had all the neatness that I could desire. Besides the com-

mon subdivision of the ring, I perceived, very distinctly, that the outside ring, which is the narrowest, was divided into two equal parts by a dark line. This line exhibits itself like the principal one seen in telescopes of less power. It may be followed from the extremities of the ansæ to their nearest proximity to the globe of the planet. It is equally distinct in the two ansa. The interior ansa of the interior ring, which always appears paler, presented an appearance which I had not before witnessed. A shadow, pretty wide at the inward edge, and narrowing off to a point at each ansa on the surface of the ring, had a rounded appearance, (l'apparence d'un arrondissement.) A certain number of fine lines were perceptible nearly parallel with the interior rounding, which penetrated the shadow in every part of the surface of the ring over which it extended. This appearance was particularly observable on the west side of the ring, seen to the left in the telescope.

On the 20th of May, the apparent division of the exterior ring was still visible, but the fine lines above alluded to were not discernible, for want, probably, of transparency in the air. I endeavoured, on the 28th of May, when the night was not as clear as that of the 25th of April and the 20th of May, to measure, by two trials, with the thread micrometer, the position of the lines of separation on the ring, as well as the exterior and interior diameters of the ring, and the equatorial and polar diameters of the planet. The values obtained and reduced to the mean distance of Saturn, were as follows:—

Exterior diameter of the exterior Ring . .	40″.445
Diameter of the new subdivision . .	37 .471
Interior diameter of the exterior ring . .	36 .038
Exterior diameter of the interior ring . .	34 .749
Interior do. do. do. . .	26 .756
Equatorial diameter of Saturn . . .	17 .519
Polar do. do. . . .	15 .927

These values appear to indicate that the line of separation is nearer the interior than the exterior border of the ring, but this conclusion is not to be regarded as devoid of uncertainty. The numbers obtained are sensibly greater than those of M. Bessel, and the results of my measures of this kind appear to me, in fact, to surpass, in general, those of M. Bessel, and even those of M. Struve. By the comparison of a great number of measures of this sort, the cause of this difference may be properly ascertained.

M. Encke then discusses observations of the same kind made by others, and among the rest, those of Captain Katér, which he did not recollect till after he had made his own. It appears that this phenomenon is variable, or that it requires a very special clearness of atmosphere, since Herschel and Struve could not distinguish, in the course of 1826, with their instruments, the new subdivision which Captain Kater and two other observers witnessed at the close of 1825, with less powerful apparatus. (Mem. Astron. Soc. Lond. v. 4.)

M. Encke reminds us that the face of Saturn's Ring, which was seen from the earth in 1825, is not the same as that which is now visible, so that the black line, as it is seen on each side of the ring, is, in all probability, a real division.

M. Arago appears to have observed it also at Paris, once in 1823, with a large achromatic telescope. Captain Kater and another observer thought they discovered, like Short, a greater number of black streaks or subdivisions of the outward ring, while a third person, who was observing with

them, could distinguish but one. M. Encke remarks on this, that the declination of Saturn was north in 1825, whereas it is now south, which, perhaps, may have prevented the other lines from being distinguished. M. Encke announces to M. Schumaker, in the same letter, that the two stars forming the double star γ of the Virgin, after having appeared for some time, on account of their reciprocal motions, so near each other as to appear like a single star, have been distinctly separable since the 29th of May of the present year. (Bib. Univ. Dec. 1817, or for further details, Astron. Nachr. No. 338.)

Ibid., Mars, 1838, Sup.

Electrical Phenomena.

M. Robert informed the Academy that on Wednesday, the 25th April, about 6, P. M., a few moments before the bursting out of a storm at Paris, he observed an enormous mass of cloud, towards which very numerous small clouds appeared to be attracted, and into which they were eventually precipitated.

Many persons say that this is not a rare occurrence. In some countries I have been told, where the clouds present those phenomena, they are called *diablotins*, (little devils.)

A fact somewhat curious was stated by M. Arago, that in Paris there are certain localities which appear to be much more likely to be struck by lightning than others. The Elysian Fields and the neighbourhood of the Place de la Concorde are in the number of these *privileged places.*

M. Becquerel, in his instructions to scientific voyagers, wishes them to observe the electrical intensity of the atmosphere. In clear weather, the air is a vast reservoir of positive electricity, the intensity of which increases from the surface of the earth to an unknown height. A few hours before and after the rising of the sun, this intensity shows two *maxima*, and a few hours before and after his setting, two *minima*, and these variations increase from July to January, so that the electricity of the air is much greater in winter than in summer.

In cloudy weather, the atmospheric electricity varies both in its nature and its intensity, and sometimes very rapidly. The intensity is much greater than in clear weather. No law has hitherto been established, only that in the course of a year, the number of positive days are about equal to the negative.

The atmosphere and the ground are always in opposite states, and these two electricities must be continually combining in the lower strata of air by means of the bodies on the earth's surface. In the open country, the positive electricity is found to commence at a little more than a yard above the surface in decidedly serene weather. It would be useful to study the variations of this height in different places and under different circumstances.

Near waterfalls, the atmospheric electricity is said to be negative, even under a serene sky. This fact deserves to be examined more fully.

When an electrical discharge passes through a body of sand in its nearest course to water, it produces vitrified tubes, called thunder pipes. These ought to be better examined.

Thermo-electric instruments ought to be applied to ascertain whether it is true that the internal heat in men and animals diminishes in going from the poles to the equator.

M. Peltier proved, several years ago, that in clear weather, the ground and the bodies upon it are negative, while the atmosphere above, beyond

local influence, is positive: when the clouds are negative in their lower strata, terrestrial bodies then change to positive, and this change of electrical condition is felt more or less according to the constitution of different persons, and the electrical intensity of the storm, producing complaints of heavinesss, headache, and a general listlessness, which people cannot account for. M. Peltier stated that in a storm on the 5th of May last, the inferior clouds were negative. Idem, Mai.

Progress of Civil Engineering.

"*On the Teeth of Wheels.*" *By* ROBERT WILLIS, *Jacksonian Professor of Natural Philosophy, in the University of Cambridge.*

The geometry of the subject of the teeth of wheels may be considered as complete, but it appears that important additions may be made to its practical applications. The general problem is, having given a tooth of any form, to determine one which shall work correctly with it. The method of effecting this may be shown in a simple, practical manner. The curve to be traced out, which is the shape of the required tooth, is the locus of the intersections of all the outlines of the tooth in every one of its positions. The motion produced by the mere contact of the curve so traced out with the given tooth, will be uniform. This, then, is a practical mode of showing the practicability of the problem.

The epicycloids and involutes have hitherto, from the facility with which they can be described, been almost universally employed, and practice has been confined to the class of epicycloids which work correctly with straight lines or circles. The defect under which such wheels labor is, that a wheel of fifty teeth of the same pitch will not work correctly with a wheel of one hundred teeth of the same pitch; since the diameter of the describing circle by which the epicycloid is formed, must be made equal to the radius of the pitch circle of the wheel with which the teeth are to work, and will therefore be twice as large in the second case as in the first. Also, if the teeth be epicycloids, generated by a circle whose radius is equal to that of the wheel with which it is to work, which is equally correct, the same remark applies.

This defect was of no great consequence when the teeth were wooden, but it is of great consequence in iron wheels, since the founder must have a new pattern of a wheel of forty teeth for every combination that it may be required to make of this wheel with others. It is desirable that the teeth of wheels be formed so that any tooth may work correctly with any other of the same pitch. This is the case with involute teeth, but the obliquity of the action is an objection to their introduction. The requisite property may be given to epicycloidal teeth, by employing the following proposition. If there be two pitch circles touching each other, an epicycloidal tooth formed by causing a given describing circle to roll on the exterior circumference of the first, will work correctly with an interior epicycloid formed by causing the same describing circle to roll on the interior circumference of the second.

From this, Professor Willis deduces the corollary, that if for a set of wheels of the same pitch a constant describing circle be taken and employed to trace those portions of the teeth which project beyond each pitch

line by rolling on the exterior circumference, and those which lie within it by rolling on its interior circumference, then any two wheels of the set will work correctly together. This corollary is new, and constitutes the basis of the system already alluded to.

It only remains to settle the diameter of this constant describing circle. The simplest considerations serve to show that the diameter of the constant describing circle must not be greater than the radius of the pitch circle; hence, as a convenient rule, make its diameter equal to the radius of the least pitch circle of the set. This rule is perfectly general, applying to racks and large wheels, as well as to annular or internal wheels. The simplicity of this above the old system is obvious, for on the old every epicycloid requires two circular templets; also there must be as many templets as pitch circles in the set, whereas on this system but one describing templet is required.

For machinery in which the wheels move constantly in the same direction, the strength of the teeth may be nearly doubled for the same quantity of material, by disposing it so that the backs are an involute or the arc of a circle, the acting faces being of the usual form.

In the preceding the exact forms have been described; the author then proceeds to ascertain forms sufficiently accurate for practice, and which are arcs of circles. Euler suggested the substitution of arcs of circles of curvature instead of the curves themselves. The portion of a curve employed in practice is so small, that a circular arc is sufficiently accurate, provided the centre and radius with which it is struck be determined by some more accurate method than by mere trial. With this view Professor Willis was led to investigate a method in which the nature and properties of curves proper for teeth are entirely neglected, and a simple construction is shown by which a pair of centres may be at once assigned for a given pair of wheels, whence arcs may be struck that will answer the purpose of enabling these wheels to work correctly together.

The nature of the motion produced by the pressure of one circular arc against another is then examined and reduced to that of a system of three rods, the middle one of which is joined to two others, movable at their other extremity about a fixed centre; and a simple construction is arrived at by which we may always find a pair of centres for which two circular arcs may be struck through any point, which will drive each other truly for a small distance on each side of that point. This point, when the side of a tooth consists only of a single arc, should be on the line of centres. It is, however, more advantageous that the tooth should consist of two arcs, for then there will be two points at which the action is exact—one a little before reaching the line of centres, the other a little after passing it.

From these investigations, the author was led to construct an instrument for setting out the teeth of wheels, which may be used with perfect facility by the workmen, and which has been termed an Odontograph, the application of which is fully described. The paper contains many practical observations connected with this subject, tables, &c., and concludes with some directions for ascertaining the correct form of cutters. Inst. Civ. Eng.—Lond. Journ.

"*The Canal Lifts on the Grand Western Canal.*" *By* James Green, *M. Inst. C. E.*

The lift, which is the subject of the following paper, was erected by Mr. Green in the year 1835, on the Grand Western Canal, and has been in ope-

ration ever since. Lifts are not intended to supersede the use of locks in all cases, but in those in which a considerable ascent is to be overcome in a short distance, and in which the water is inadequate to the consumption of a common lock, or in which the funds are inadequate to the execution of the work on a scale adapted to such locks.

This lift is 46 feet in height, and consists of two chambers, similar to those of a common lock, with a pier of masonry between them; each chamber being of sufficient dimensions to admit of a wooden cradle, in which the boat to ascend or descend floats. The cradle being on a level with the pond of the canal, a water-tight gate at the end of the cradle and of the pond of the canal is raised up, and leaves the communication betwixt the water in the canal and in the cradle free, and the boat swims into or out of the cradle.

The cradles are balanced over three cast-iron wheels of 16 feet in diameter, to the centre of one of which is fitted spur and bevil gear, so that the motion may be given by machinery worked by the hand, without any preponderating weight of water in the cradle, when scarcity of water renders this necessary. To this hand-gear is also attached brake wheels and a brake lever for regulating the motion. For the details of the construction of this machinery, and of the manner in which the lifts are worked, reference must be had to the drawings.

It is obvious that the weights of the additional length of the suspending chains on the side of the cradle which is the lowest must be counterbalanced; for this purpose there is attached to the under side of each cradle a chain of equal weight per foot with the suspending chain, and this elongates under the ascending and is shortened under the descending cradle; thus the disparity in the weights due to the suspending chain is obviated.

It is so arranged that the water in the upper cradle is about two inches below the level of the water in the pond: the consequence of which is, that the upper cradle has a slight preponderance first, sufficient to set the machinery in motion; the weight of this water is generally about one ton; it may, however, be regulated at pleasure.

The strength of materials is the great desideratum in machinery of this nature, and though the lift here described is but 46 feet, and the boats about 8 tons, the same method is applicable to much greater heights and larger tonnage. The advantages of these lifts over common locks are great economy of construction, and great saving of time and water.

The time occupied in passing one boat up and another down this lift of 46 feet is three minutes, whereas thirty minutes would be required to attain the rise of 46 feet by locks; thus the saving in time amounts to $\frac{9}{10}$ths for boats of eight tons.

The quantity of water consumed is about two tons for eight tons of cargo, whereas in common locks it is about three tons of water per ton of cargo; the saving is therefore 22 parts out of 24, or very nearly 92 per cent. If the trade were all downward, there would, by the use of these lifts, be carried from the lowest to the highest level of the canal a quantity of water equal to the loads passed down.

Mr. Green stated, in reply to several questions, that in some parts of the canal it had been found impracticable to get a sufficient drain to empty the chamber—they were compelled, therefore, to use a half lock of 18 inches fall; that there were seven lifts and one inclined plane on the canal, effecting a rise of 262 feet in eleven miles. That he should not recommend them as applicable to boats of more than 20 to 30 tons. The width of

larger boats was an obstacle. They were extremely advantageous for narrow canals; for boats of 50 or 60 feet in length, and about 30 tons.

Mr. Parkes remarked, that he considered the question of narrow canals as a most important one—the advantage to be derived from narrow canals was a subject to which sufficient attention had not been paid.

The President called attention to the remark in Mr. Green's paper respecting the quantity of water carried up from one level to another in a downward trade wherever these lifts are used; then a coal country on high level may supply itself with as much water as it sends down coal. The subject of inclined planes being alluded to, especially those of the Morristown Canal of 200 feet each, where a rise of 1600 feet is effected by eight inclined planes, Mr. G. remarked, that more water and time must be expended, the friction and length being much greater. In the lifts there was only as much water consumed as was equal to the load, but that he should not consider them as practically applicable to more than 60 or 70 feet. Favorable levels, with ascents of more than 60 or 70 feet, could seldom be found; could he have had the choice of the line in this particular instance, he should have effected by four lifts the rise for which seven are now employed.

Ibid.

"*The Land Surveyor's Calculator.*" *By* George Heald.

The instrument to which the above name is assigned, was invented for the purpose of avoiding the necessity of performing long arithmetical calculations in surveying estates; the results are given at once by the adaptation and inspection of the instrument. It may also be applied to extracting the square roots of numbers, and to the other purposes to which the Gunter's scale is applicable.

The instrument consists of five concentric circles, whereof the four inner ones are on the outer edge of a card movable about a centre, and the fifth on the outer circle is fixed. The circumferences of the two outer circles—that is, of the fixed circle, and the circle at the edge of the movable card—are divided into 1000 logarithmic portions representing links, the divisions being carried round in a contrary order, on the two circles. The third circle is divided to represent acres; the fourth to represent perches; and the fifth, or innermost circle, expresses the area in acres, roods, and perches.

The author then describes the method of using the instrument for the solution of questions similar to the following. Knowing the diagonal and the two perpendiculars of a quadrilateral, or the base and perpendicular of a triangle, to determine the areas of the respective figures; the result is known at once in acres, roods, and perches, on inspecting the fourth or fifth circle, according as the area is greater or less than half an acre. The instrument may also be applied to computing square yards; to extracting square roots of numbers; and to the ordinary operations of multiplication and division, in the same manner as other logarithmic lines.

A great advantage of this instrument results from the graduation being on the circumference of a circle. Great enlargement of the divisions is thus obtained, and in a far more convenient form than by drawing a slide, as on the common sliding rule; the diameter of the outer circle in this instrument is sixteen inches. The author considers that a circle of eight inches diameter would be sufficiently accurate for practical purposes; and such an instrument would be extremely compact and portable.

Ibid.

French Locomotives.

On the 25th October, the first locomotive ever built by French engineers with French iron, was tried on the St. Cloud and Paris Railway. It is, say the accounts, from 40 to 50 horse power; and able to draw 100,000 kilogrammes, or 20 laden wagons. The trial was perfectly satisfactory: it made the journey from Paris to St. Cloud in 16 minutes, and the journey back in 13½, which is at the rate of about 33 miles an hour. Its name is the *Alsace;* and it is curious to observe, that notwithstanding the boast of its being built by French engineers, it owes its origin to a province, politically French, indeed, but in language, manners, and character, still essentially German. It was built at the manufactory of Messrs. Stehelin and Huber, at Bitschwiller, in the department of the Upper Rhine, in Alsace—a manufactory large enough, it is said, to supply twelve locomotives a year—under the immediate superintendence of Mr. Stehelin, to whose talents it is indebted for a peculiar lightness and elegance of construction. The iron is more indubitably French, being supplied from the works of M. Muel-Doublas, at Abainville. The price of the locomotive is said to be no higher than that of an English one; as, though the cost of the iron is, of course, greater, the difference is made up by the less amount of wages paid to the workmen. Lond. Mech. Mag.

Bridge over the Danube.

The new suspension bridge over the Danube, between Buda and Pesth, which will be begun next spring, is a colossal undertaking. Two piers of granite and the red marble of Neudorf, 35 feet thick, and 150 feet above the level of the foundation, will support the whole structure. There will consequently be three openings for the water to pass through, the middle passage being 640 feet in width, and each of those at the sides 270 feet, making in all 1,180 feet. The entire length of the bridge will be 1,600 feet. Cast-iron beams will support the platform, which is to be 37 feet wide, viz. 25 feet for the carriage way, and six feet for each foot path. The whole will be suspended by 12 chains, weighing together upwards of 2000 tons.

Ibid.

The Suspension Bridge at Freyburg,

The longest in the world, was completed and thrown open in 1834. The engineer who constructed it is M. Chaley, of Lyons. Its dimensions, compared with those of the Menai bridge, are as follows:—

	Length.	Elevation.	Breadth.
Freyburg	905 ft.	174 ft.	28 ft.
Menai	580	130	25

It is supported on four cables of iron wire, each containing 1056 wires, the united strength of which is capable of sustaining three times the weight which the bridge will ever be likely to bear, or three times the weight of two rows of wagons extending entirely across it. The cables enter the ground on each side obliquely for a considerable distance, and are then carried down vertical shafts cut in the rock, and filled with masonry, through which they pass, being attached, at the extremity, to enormous blocks of stone. The materials of which it is composed are almost exclusively Swiss; the iron came from Berne, the limestone masonry from the quarries of the Jura,

the woodwork from the forest of Freyburg; the workmen were, with the exception of one man, natives, who had never seen such a bridge before. It was completed in three years, at an expense of about 600,000 fr. (25,000l. sterling.)—*Handbook for Switzerland.* Ibid.

Birmingham Railway.

There are only two coaches (formerly 22) now running to Birmingham from London, which will be put down in a few days, in consequence of the railway directors having purchased up the interests of the individuals to whom they belonged. In order to prevent the jobbing of the railroad monopolists, several public spirited individuals have determined to put three of Stafford's patent safety coaches on that road immediately, and we hope they may succeed, despite their tyrannical opponents. The Worcester mail has been again put on the road, in consequence of the uncertainty of railroad travelling.—*Worcester Herald.* Min. Journ.

Mechanics' Register.

East Indian Caoutchouc.

It is well known that a large supply of this valuable substance might be procured from India, if the same care were to be taken in gathering it as in South America. "The London Caoutchouc Company," impressed with this idea, accordingly sent to India an offer of a premium of fifty pounds for the first hundred weight of East India caoutchouc which should be shipped for England. When the offer arrived, however, it was somewhat of the latest; the great demand existing at home for the article had been heard of, and large quantities were already on shipboard, compared to which the "hundred weight" stipulated for was but as a molehill to a mountain! The whole affair forms an apt illustration of the doctrine, that, in commerce, the force of self interest is far superior to that of artificial bounties.

Mech. Mag.

Woolf's Engine Re-invented.

Mr. James Duncan, watchmaker, at Glenluce, has lately constructed a small steam engine on the high pressure principle, the novelty of which consists in the steam acting twice in the cylinder before it escapes into the atmosphere, by which there is a saving of half the fuel, and half the water, which a common engine of the same power would require.—*Ayr Observer.*

Mech. Mag.

Wheatstone's Electrical Telegraph.

On the bank by the side of the Great Western Railway, the directors are now laying down iron tubes containing wires, for communicating with the various stations by means of Wheatstone's electrical telegraph. The advantages, if it succeed, will be immense; the expense, we have heard, is about 100*l.* per mile. Ibid.

New Cordage.

The brothers Landauer, of Stuttgard, have obtained a patent for a new species of cordage; the threads of which are not twisted one over the other, but united in a parallel direction. A cord, 1¾ inch in circumference, sustained a weight of 1300 lbs. without breaking, and when at last an addi-

tional weight caused it to break, the fracture resembled a cut with scissors, which proves that each thread was of equal strength. A cord of 504 threads, $3\frac{1}{16}$ inches in circumference, 111 feet long, woven in this manner, only weighed 19 lbs.; whilst an ordinary cord of the same circumference and length, and as many threads, weighed $51\frac{1}{2}$ lbs. Lond Mech. Magazine.

Artesian Well.

The bore which has been going on for so long a period near Paris, has now reached the depth of 410 metres (or about 1345 feet) and the funds being exhausted, M. Elie de Beaumont has been requested to examine the matters lately brought up by the auger, and to say whether they afford any indication by which the thickness of the bed to be pierced, before arriving at the sand, may be gathered. M. de Beaumont has accordingly given his opinion, that the bore has reached the lower beds of the chalk formation, and that the marls and gault which still intervene between the bore and the stratum where the water will be found, will, probably, be less than 100 metres thick, (328 feet.) If M. de Beaumont's anticipation should prove correct, the well should have a depth of 1600 feet, at which depth, according to recent calculations, the water should have a temperature sufficiently high to furnish Paris with an abundant supply of hot water for baths and for many other purposes. Mining Journ.

Machine Manufactory in Holland.

A company is at present forming in Holland for an undertaking of national importance, the establishment of a great manufactory of machines. Hitherto Holland has been almost entirely supplied with these from abroad, but the new company has been already joined by so many of the first manufacturers, as to hold out a strong prospect of success. At present, the most important establishment of the kind in Holland is the steam engine manufactory of the Steam Navigation Society at Feyenoord, near Rotterdam. Many hundred workmen are employed there, and a great number of steam engines are in course of manufacture, as well as a sea steamboat of 200 horse power. Lond. Mech. Magazine.

On the Use of Metal in Candles.

Much having been of late before the public respecting the making of candles, we venture shortly to bring the question before our readers.

To produce a candle that requires no snuffing, it is necessary that the whole of it, wick included, should burn away in flame; very fine wax and well refined spermaceti seem to be best suited for this purpose. To render other candles equally volatile, *arsenic* has been used with success; but the health of the community does not seem herein to have been regarded. Those candles which are used in the candle lamps, and sold under the name of metallic wick candles, have a small portion of the metal called bismuth introduced into them, which metal is perfectly harmless; it has the property of rendering the combustion of the candle more perfect, producing a white flame, and preventing the unpleasant smell that is observed on entering a room lighted with common tallow candles.

Bismuth, in the form of a white powder, is sold by perfumers as a cosmetic. Rep. Pat. Inv.

LUNAR OCCULTATIONS FOR PHILADELPHIA, APRIL, 1839.					Angles reckoned to the right or westward round the circle, as seen in an inverting telescope. ☞ For direct vision add 180° ☜	
Day.	H'r.	Min.	Star's name.	Mag.	from Moon's North point.	from Moon's Vertex.
2	13	30	Im. 1 b Scorpii	5	67°	48°
2	14	57	Em.		241	240
19	7	55	Im. 76 c Geminorum	6	102	157
19	8	56	Em.		212	271
20	10	33	Im. 43 γ Cancri	5	27	83
20	11	27	Em.		277	332

Meteorological Observations for October, 1838.

Moon.	Days	Therm. Sun rise.	Therm. P.M	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inch's	Inch's			Inches.	
	1	55	71	29.95	30.00	N.W.	Calm.		Clear—do.
	2	57	70	94	29.94	N.W.	do.		Clear—do.
	3	60	70	80	80	W.S.W.	do.		Lightly cloudy—clear.
○	4	48	59	30.00	30.00	W.S.W.	do.		Clear—do.
	5	51	71	29.95	29.91	S.W.	do.		Clear—do.
	6	56	72	82	72	W.	do.		Lightly cloudy—do. do.
	7	53	59	72	85	N.	Brisk.	.04	Rain—clear.
	8	40	55	90	83	N.E.	Moderate.		Clear—do.
	9	42	650	75	72	E.	do.		Clear—cloudy.
☽	10	54	59	65	52	N.E.	Brisk.	1.25	Cloudy—rain.
	11	46	43	40	54	S.W.W.	do.		Cloudy—do.
	12	43	50	75	71	S.W.	Moderate.		Partially cloudy—do. do.
	13	39	5	90	90	W.	do.		Clear—do.
	14	45	61	60	73	S.W.	do.		Cloudy—lightly cloudy.
	15	56	56	60	60	S.W.	do.		Cloudy—do.
	16	38	52	94	30.00	W.	do.		Clear—cloudy.
	17	37	54	30.25	76	W.	do.		Clear—do.
	18	36	53	34	30	S.W.	do.		Clear—cloudy.
⊗	19	49	59	05	29.84	E.S.E.	do.	1.60	Rain—do.
	20	43	50	29.83	85	W.	Brisk.		Clear—do.
	21	42	50	84	84	W.	do.		Cloudy—flying clouds.
	22	38	52	90	95	W.	Moderate.		Clear—flying clouds.
	23	34	52	30.15	15	W.	do.		Clear—cloudy.
	24	42	42	29.85	65	S.E.W	do.	.80	Rain—do.
	25	42	53	60	60	S.E.W.	do.		Cloudy—flying clouds.
☾	26	36	53	85	92	W.	do.		Clear—do.
	27	44	57	81	81	W.	Calm.		Flying clouds—do. do.
	28	42	42	85	85	N.W.	Moderate.	.15	Cloudy—rain.
	29	34	42	70	76	W.	Blustering.		Clear—do.
	30	33	45	90	90	W.	Moderate.		Clear—lightly cloudy.
	31	36	41	90	30.00	W.	Brisk.		Clear—Flying clouds.
	Mean	44.23	55.10	29.85	29.84			3.84	

	Thermometer.	Barometer.
Maximum height during the month.	72. on 6th.	30.76 on 17th.
Minimum " " "	33. 30th.	29.15 23
Mean	49.665	29.845

Erratum. The term Enpion, frequently used in Moll's Specification, page 100, of the present number, though copied literatim from the British Journal, should be *Eupion*, from the Greek *eu*, well, and *pion*, greasy. G.

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

AND

MECHANICS' REGISTER.

MARCH, 1839.

Practical and Theoretical Mechanics and Chemistry.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

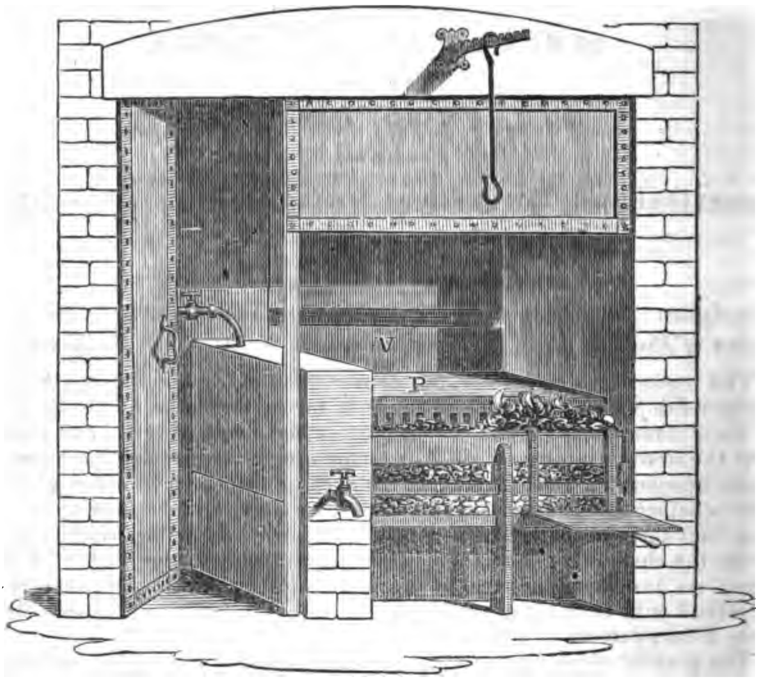
Description of a Kitchen Range, and Fire place, constructed under the direction of Prof. R. Hare, *of Philadelphia, and now in use in his Kitchen.*

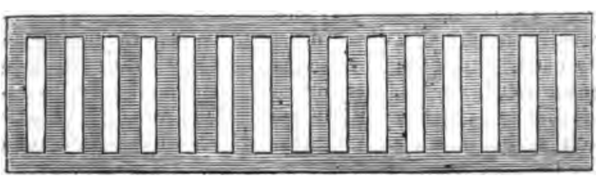
The numerous devices for the construction of cooking apparatus and kitchen fire-places, and the unceasing and successful efforts which are made by their inventors to induce the public to adopt them, serve to render manifest the desire existing in the community to find something more convenient, economical, and efficient for the purpose than such as are in general use; whether this is attainable, remains to be proved, and one thing is certain, that there never will be a general agreement respecting which is best. From the character given of the apparatus employed in the family of Dr. Hare, we have been induced to procure an engraving of it, and have been furnished with such a description as, with the engraving, will give a clear view of its structure and use.

The greatest objection to the kitchen ranges devised by various ingenious projectors, is the want of simplicity. Cooks will not take the trouble of learning to use them, or, which is necessary, to keep in order the various novel articles by which they are accompanied. Stoves are objectionable, when used for cooking, on account of the annoying fumes of the articles subjected to the process not being generally carried up the chimney.

The fire place constructed by Dr. Hare differs from those in which anthracite is generally used, 1st, in the elevation of the lintel so that the cook can enter the fire-place and reach the pots and kettles from one side, instead of scorching the face and arms in front of the fire. 2d, in having a massive cast iron grate, with vertical bars and interstices behind the fuel, and a plate, P, of the same metal, resting partially on this grate, and extending about sixteen inches back towards the wall. This plate is kept hot by the heat received through the interstices of the grate, or by contact with the

mass of iron of which they constitute a part. A gentle draught takes place under this plate in consequence of a space left between it and the back wall, and another plate placed parallel to the wall vertically. Between this plate and the wall, the air, being warm, rises, and thus causes an effort in the adjoining air to enter and replace it. The horizontal plate is in fact made so hot as to keep pots and kettles boiling after being once made to boil on the fire. This plate serves also the purpose of an oven. A pie or pudding, being supported on the plate, with the interposition of a brick or tile between them; the cover of sheet iron, represented at (O,) is placed over it, and live coals are placed upon the top of the cover in sufficient quantity to produce a baking or a browning heat. Of course this process is applicable to the operation of browning meat previously stewed.





G

Scale of 1¼ Inch to the Foot.

O

The boiler on the side of the fire not only serves to keep up a supply of hot water, but is likewise a defence to the cook in handling the pots and kettles from the side. Although the chimney, while wood was used in it as fuel, often failed to carry off the smoke, there has been no inconvenience arising from that cause since the plan above described was resorted to. Contrary to expectation, the chimney draws well at all times, without closing the door. In the association of the permanent boiler with the grate, it is not pretended that there is any thing new. In Dr. Hare's kitchen, water is supplied by a cock terminating a hydrant pipe; but the contrivance called the ball cock would be preferable; and it would be still more advantageous to have a cylindrical water-tight vessel capable of bearing the pressure of the water from the water works, agreeably to the plan pursued by Messrs. Morris, Tasker and Morris. By a boiler of that kind a constant supply of hot water is had without the trouble of replenishing the containing vessel.

It is important that the back grate should be very stout; it should form a large mass of metal, for its own protection in the first place; and in the second, in order that it may, by the conducting process, transfer heat from the fire to the plate resting upon it at the front edge. By these means it proves a reservoir of caloric, and serves to detain and render it more useful. The weight of the grate employed is eighty-four pounds.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Novel Mode of Cooking Tough Meat, so as to render it Tender.

It was stated to Dr. Hare, by Mr. Jacob Perkins, now of London, that an old fowl, or a tough piece of meat, might be made tender by exposing it to the temperature of boiling water for a considerable length of time, the meat being placed in a vessel into which the water did not enter. The experiment was tried by Dr. Hare on a tough piece of beef; the apparatus used by him consisted of two vessels, one placed within the other, the space between them being filled with water, and the beef being closely covered in the inner one. The water was kept boiling for nearly twelve hours, and the results verified the statement of Mr. Perkins; the meat was rendered tender, and, with the aid of proper condiments, an excellent bouillie was obtained. Steam, of course, might be substituted for the boiling water, as the requisite degree of heat would be obtained by causing it to pass round the vessel containing the meat.

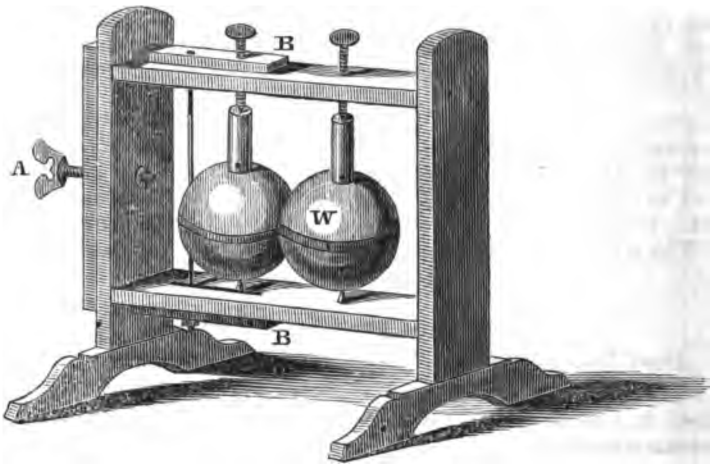
FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Apparatus intended to show that if heat be motion, the capacity of Mercury should be greater than that of Water. By R. HARE, M. D., *Prof. of Chemistry, University of Pennsylvania.*

Sir Humphry Davy had suggested that heat might be ascribed to a gyratory or vibratory motion in the particles of ponderable matter. I have urged that if heat were motion, the laws of its communication should be analogous to those which operate between moving masses, and that as in the latter case the heavier body would have most influence in communicating motion, so in the former the heavier body should be more efficacious in communicating heat. Yet the facts were totally opposite to this community of result. Mercury, nearly 13.6 times heavier, bulk for bulk, than wa-

ter, and of course in communicating motion as many times more potent, had, in communicating heat, an effect only the half of that producible by a like bulk of water. A similar incongruity existed in every instance where the heating influence of a metal could be compared to that of water.

Professor Olmsted, of Yale College, alleged the law of motion to which I appealed, only to avail in case of motion in right lines: that it could not be applicable in the case of gyratory or rotary momentum. To verify the truth of my postulate, by ocular proof before my pupils, the apparatus represented below was contrived.



Both the globes, represented in the engraving, are of wood, but one of them, W, is loaded with a zone of lead. Either of the globes may be made to revolve upon its axis with great rapidity, by applying a string as in spinning a humming top. When one of the globes is set in motion, it is not to be in contact with the other, but by means of the slides at B, B, governed by a screw A, complete contact may be produced between them without disturbing that to which motion has been communicated. The momentum previously induced in one is thus divided between both, and the difference of its duration, accordingly as the heavier or lighter globe is the mean of communicating it to the other, is strikingly in favour of the heavier globe. I will not add Q. E. D., because I should have supposed that the issue would have been sufficiently self-evident to every person having any knowledge of the subject, either in practice or in theory, yet as I was contradicted, flatly, by a respectable professor, and one for whom, personally, I have no small regard, I thought it best to prepare for my medical pupils, who are not supposed to be generally acquainted with mechanics, an ocular proof of the position on which my reasoning had been founded. The experiment has always excited much interest, and lessened the tedium of a theoretic discussion, in general abstruse, and unsusceptible of pleasing illustrations.

Physical Science.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Col. Reid's Law of Storms examined. By J. P. Espy.

Continued from p. 50.

The following investigation of the storm of 1821, was written early in the year 1838, and presented to the Joint Committee of the American Philosophical Society and the Franklin Institute by me, in my official capacity as meteorologist of that Committee; but it was not accepted. I now publish it on my own responsibility; and as this storm has been copied by Col. Reid into his book, it may now be considered as a part of the examination of his law of storms, though it was written before his book was published. This much it was necessary to say in explanation of the peculiar phraseology of what follows, since it is published verbatim as it was read to the Committee.

Philadelphia, Jan. 10, 1838.

Gentlemen:—As the meteorological instruments ordered by the Committee have not yet all been made, and distributed to the several counties of the state, and as recent materials have consequently not yet been furnished to your meteorologist for a report, I have thought it would be interesting and useful to the cause in which we are engaged, to investigate the phenomena connected with the great storm which visited our coast Sept. 3d, 1821.

I have chosen this storm in preference to others, because materials for its investigation are more abundant, and also because Mr. Redfield thinks "there is but one satisfactory explanation of the phenomena. "*The storm was exhibited in the form of a great whirlwind.*"

Now it is of immense importance to the mariner that he should have correct views on this point—and I propose to demonstrate that this storm at least was not exhibited in the form of a whirlwind, but was like the twelve storms which have been investigated by the Joint Committee of the American Philosophical Society and the Franklin Institute, that is, the wind blew inwards at its borders.

This conclusion is rendered certain by the following facts, which are deductions from the particulars given below.

1st. The storm set in every where on the extreme south-east border from the south-east, and not from the south-west, and changed round to the S. S. W. or S. And on the extreme N. W. border it set in from N. N. E., and blew hardest from the N. and N. W. Now on the extreme S. E. border it could not blow from the S. E. at all, on the supposition that it was a whirlwind; nor, on the N. W. side, could it blow at all from the N. W. Both facts, however, are not only consistent with a centripetal motion of the air, but absolutely prove it.

2d. Wherever the wind set in from the E., it always changed round by the S., which is consistent with the centripetal, and inconsistent with the centrifugal, theory.

3d. There never was a lull mentioned, only where the wind set in from the N. E., which has the same bearing as before, for the centre of the storm only can have a lull.

4th. Where the wind set in from the S. E, there is no lull mentioned previous to a change of wind, and in no instance could I find that it changed round to N. W. Two instances are given by Mr. Redfield, one at Bridgeport, Conn., which I find is incorrectly reported, and instead of changing

round to N. W., it should read to S. W.—the other at sea, 40 miles N. of Cape Henry; this I could not find, and I suspect there is something wrong in it, for 40 miles N. of Cape Henry is not at sea, but in the eastern shore of Virginia. At other places in a right line with this, it set in from the N. E., e. g. at Cape May and Norfolk.

5th. Along the seaboard, where the wind had been S. and S. E. all day, at the approach of the storm, it backed round towards the E. and E. N. E.; and inland, where the wind had been N. W., it backed round towards the N. and N. E. on the approach of the storm.

6th. Wherever the wind set in from the N. E., it ought not to have changed at all, according to the centrifugal theory, whereas it did actually always change round by the N. to N. W. or W., or by the S. to S. W., as it should do by the centripetal theory.

7th. According to the centrifugal theory, the wind never could change round on the extreme N. W. boundary from the N. N. E. to the N. W. as it did, according to the centripetal theory.

8th. On the extreme S. E. boundary it could not blow at all from the S. E. according to the centrifugal theory: but it did according to the centripetal theory, blow in that direction in many places on that border, for 6 or 8 hours during the whole strength of the gale.

9th. On the extreme N. W. border, according to the centrifugal theory, it could not blow the hardest from the N. W., nor on the extreme S. E. border could it blow the hardest from the S. E., as it did in exact conformity with the centripetal theory.

10th, At Cape May it changed round from N. E. by E., and at Cape Henlopen it changed round from N. E. by N., in conformity with the centripetal, and entirely contradictory to the centrifugal, theory.

11th. Both in Norfolk and New York, the wind set in from near the N. E., and at the termination blew from the S. W., which is the experimentum crucis in favour of the centripetal theory, and utterly inconsistent with the other. In like manner at Ocracoke, it set in E. S. E. and terminated S. S. W., and out at sea, in the extreme eastern borders of the storm, the wind blew for 8 or 10 hours from S. E. and S. by E., with but little change, as it ought to do, if the wind does actually blow towards the centre of the storm.

12th. At the time the wind changed round to S. S. W. at Ocracoke, it was blowing at Norfolk a violent gale N. E., nearly towards Ocracoke. Now as these places are 130 miles apart, and nearly on opposite sides of the storm at that moment, it is utterly impossible, according to the whirlwind theory, that the wind at Ocracoke should be blowing towards Norfolk, and, at the same time, the wind at Norfolk be blowing towards Ocracoke. And this fact is entirely consistent with the centripetal theory.

The wind also changed round at Norfolk S. W. sometime before it set in from the N. E. at New York. Also two ships at sea, opposite the Jersey coast, had the wind blowing a gale from E. S. E. to S. S. E. At the same time, the wind was violent at Philadelphia and Reedy Island from N. N. E. to N. W. Now these places were nearly in opposite sides of the storm; the wind was therefore centripetal as it blew from each towards the other. Also while the storm was passing over Connecticut, the wind blew constantly, in the S. E. corner, from the S. E., while at the same time, in the N. W. corner of the state, the wind was blowing a furious gale from the N. W.; and Mr. Redfield himself testifies that the "trees and corn in this corner of

the state were uniformly prostrated towards the S. E., while even as far inland as Middletown, they were uniformly prostrated towards the N. W."

"It appears," says Mr. Redfield, "that in the central part of the state of Connecticut, the mass of the atmosphere upon the earth's surface was moving for several hours, apparently towards the N. W., with a probable velocity of 75 to 100 miles per hour, while in the northern parts of Litchfield county, (that is, in the N. W. parts of the state,) at a distance of say 40 miles, the wind, at about the same period, was blowing with nearly equal violence towards the S. or S. E."

Now, as the wind at New York changed round to "S. W., and blew away the clouds with astonishing quickness," about the time that these currents of air were rushing towards each other, from the S. E. and N. W. of the state of Connecticut, we have three points, S. E. and S. W. and N. W. in the borders of the storm, from which the wind blew towards the centre. This fact alone would establish the truth of the centripetal theory, at least in this storm.

We have no account how the wind blew to the N. E, of the point in Connecticut, towards which these three currents blew, but as the wind set in from the N. E. in front of the storm wherever we have any account, it is highly probable that here too the wind was blowing from the N. E. at the same time.

We have, then, the most decisive evidence that the wind, during the whole progress of this storm along our coast, blew inwards, at its borders, towards its central parts.

I do not say that the wind blew to one central point from every part of the circumference—this is hardly to be expected, even if the storm was perfectly circular, for reasons too obvious to require explanation.

But it seems almost certain that the diameter of the storm was much longer from S. W. to N. E. than from S. E. to N. W. The wind was only beginning to abate at noon, to a ship 75 miles S. by E. from Cape Hatteras, and this was the time the storm was commencing at Reedy Island, not far below Philadelphia. The diameter of the storm, therefore, in this direction was more than 300 miles, whilst its diameter from N. W. to S. E. could hardly have been half this quantity, for the storm was not felt at Wilmington, N. C. nor at Baltimore. And two ships off our coast, one from Charleston bound to the Chesapeake, and one from Boston to Norfolk, in latitude 40° 19', did not experience the gale. And when the storm reached Connecticut, it certainly was not more than about 100 miles broad in this direction, for at Providence it was not of a violent character, and about 50 miles N. W. of that city, the centre of the storm passed, so that here its S. E. semi-diameter was only about 50 miles. Between the Delaware Capes, also, the centre of the storm passed; for the wind changed round by E. at Cape May, and by N. at Cape Henlopen—and as the storm did not reach Baltimore, its N. W. semi-diameter was not more than 50 miles.

The shape of the storm, then, not being round, as Mr. Redfield believed, is unfavourable to the whirlwind theory, and will satisfactorily explain the circumstance that the wind did not blow exactly at times towards one central point—there was no such *point*, the centre was a *line* of considerable length.

The hypothesis of a whirlwind in this storm is therefore not true in fact; and if it was true, it is totally incapable of explaining any of the phenomena.

It does not explain the cause of the rain and hail. For, if there was a whirlwind of such violence as to make the wind in the borders of the storm

move with a velocity of 75 or 100 miles an hour at the surface of the earth, the air must have come downwards in the centre with very great velocity, a velocity calculated in my third number, unless the whirling motion extended to so great a height that the air at the surface of the atmosphere could not get in.

If indeed the rotary velocity was much greater in the middle region of the air than at the surface of the earth, or the upper regions, then the air would rush upwards below, and downwards above, towards the middle region, and the cloud there formed, if one should be formed, would be seen whirling round with great velocity and spreading outwards with proportionate rapidity. In this way, large quantities of the upper part and lower part would be mingled together—and it seems to be generally, though erroneously, believed, that the upper part, being much colder than the lower, when they meet and mingle, condensation of vapour would be the result. But as it is known from experiment, that if the air, at the temperature of 32° at the surface of the earth, should rise in the atmosphere to where the air would be expanded into double the volume, it would be colder by about 90.9°, and if the air should sink from the surface of the atmosphere to where the barometer stands 15 inches, it would rise in temperature about 90°, it follows that when these two masses of air met, the upper mass would be the warmest, and its capacity for vapour being thus very much increased, its tendency, on mingling with the lower air, would be to prevent the formation of cloud, and if a cloud was formed at all, it would be by the cold of the lower portion.

But besides the impossibility of finding any cause for this whirlwind in mid-air, it is contradicted by the whole appearance of the cloud connected with a tempest, whenever an observer is so situated as to see the whole cloud. For the circumference of the cloud always appears almost motionless, while the tempest is raging below with the greatest fury. And the upper part of the cloud, instead of rolling inwards, as it would do if there was a motion in the upper air downwards, seems to spread itself outwards, especially towards the N. E., something in the form of a mushroom, and finally into thin cirrus at the end of the rain.

On the other hand, if the air did really move inwards at the circumference of the storm, all the phenomena attending it may easily be explained on well known philosophical principles.

It could not move inwards at the circumference below, without moving upwards in the middle; it could not move upwards in the middle, without becoming colder, something more than 1° for every 100 yards of elevation, until it reached the point where condensation of the vapour would commence; above which it would cool only about half that quantity, the other half being made up by the latent caloric given out by the condensing vapour—the latent caloric cannot be given out without expanding the air in contact with it about 7000 cubic feet for every cubic foot of water generated, and thus producing a highly diminished specific gravity of the air in a rapidly forming cloud. This diminished specific gravity will cause the barometer to fall at the surface of the earth below, and the air will run inwards and upwards with a velocity which, the fall of the barometer being given, may be calculated where the storm is very narrow, as in spouts, on the principle of spouting fluids.

This upward velocity, where the barometer falls one inch, is about 240 feet a second, and is quite sufficient to cause a condensation of vapour great enough to produce those cataracts of rain which sometimes fall in a

short time over a very limited extent; and also to carry up large drops of rain above the region of perpetual congelation, and throw them off at the side of the ascending column, frozen into hail, sometimes 12 inches deep in 12 minutes. Even the shape of the tornado cloud, or water spout, is explained by the sinking of the barometer under the cloud; for the expansion of the air under the cloud may be so great that the cold produced by that expansion may cause condensation of the vapour in the air below the cloud down to the very ground. I might go on to mention every phenomena connected with storms, and show that they are all explained by the evolution of caloric in condensation of vapour; but this is not my present object.

After making one or two other remarks, I shall proceed to give the particulars from which all these generalizations have been deduced. Mr. Redfield says Dr. Mitchell has recorded, as the result of the observation of labouring people in New York, that when a haze or cirrus, which, appearing at sunset, indicates the approach of a storm, is seen over Staten Island at S. W. or more southerly, the storm of the succeeding day will blow from the *north-east*, but if it appears over the Jersey shore of the Hudson, from W. S. W. to N. W., then the storm is expected to blow from the S. E. From this it would appear that the wind blows towards the cloud of an approaching storm.

What is the shape of storms generally? or do they greatly differ in shape?

Dr. Thomas, of Richmond, N. C., told me that he has frequently seen storms of great length from N. E. to S. W., and very narrow from S. E. to N. W., make their appearance to the N. W. of where he lived, and approach him, coming up, side foremost, against a S. E. wind, pass over in half an hour, with the wind suddenly changing round to N. W. If this should be found to be the shape of those storms at sea, which Mr. Redfield says so often set in from S. E. and change round to N. W., it would be in harmony with the centripetal theory. But I forbear to hypothesize—the day is not far distant when the public will see the importance of having *facts* on this subject ascertained by a system of wide spread simultaneous observations.

Facts collected by Mr. Redfield, taken from Silliman's Journal, vol. XX.

"The earliest supposed trace of this hurricane which has been obtained, is from off Turk's Island, in the West Indies, where it appeared on the first of September, two days previous to its reaching our coast. It was felt there severely, but at what hour in the day we are not informed.

The next account we have is from lat. 23° 43′, where the storm was severe, Sept. 1st, from S. E. to S. W. Whether these two accounts are considered as identifying the storm, or otherwise, will not, at this time, be deemed material.

Our next report is from lat. 32° 30′, lon. 77° west from Greenwich, on the night of Sept. 2d; a hurricane for 3 hours.

At 3 A. M. on the 3d of Sept., a severe gale was experienced 30 miles outside of the American coast, off Wilmington, N. C.

At Wilmington there was no gale.

At Ocracoke bar, N. C., at day light on the morning of the 3d, a severe gale from E. S. E.

At Edenton, N. C. the gale was at N. E.

Off Roanoke, on the morning of the 3d, a dreadful gale at E., then S. W., and N. W.

A vessel from Charleston, S. C., two days previous to arriving in the

Chesapeake, experienced the gale at 4 A. M. on the 3d, from S. E. to W. S. W.

A vessel from Bermuda experienced the gale from the westward, on the inner edge of the Gulf Stream.

Another vessel, from Charleston, did not experience the gale.

In lat. 37° 30′, on the inner edge of the Gulf Stream, gale from the westward, with squalls.

On James River, Va. the gale was severe from N. W.

At Norfolk, Va. the gale raged, on the 3d, for 5 hours, from N. N. E. to N. N. W., and terminated at the latter point; greatest violence from 10 A. M. to 1 P. M.

At sea, 40 miles N. of Cape Henry, severe from S. E. changing to N. W.

Off Chincoteague, coast of Maryland, on the 3d, gale from S. E.

At Snowhill, Md. gale commenced at 11 A. M,

In lat. 38° 30′, lon. 74° 30′, gale S. by E.

Gale reported as slight in the Gulf Stream.

A ship from Boston, bound to Norfolk, experienced nothing of the gale On the 3d, was in lat. 40° 19′; weather foggy, and light winds from S. E.

At Morris River, Del., the gale was from E. S. E.

No Hurricane was felt at Baltimore.

At Cape Henlopen, Del., the gale, or hurricane, commenced at half past 11 A. M. from E. S. E., shifted in 20 minutes to E. N. E,, and blew very heavy for nearly an hour. A calm of half an hour succeeded, and the wind then shifted to the W. N. W., and blew, if possible, with still greater violence.

At Cape May, N. J., commenced at N. E., at 2 P. M., and veered to S. E and blew with violence. After abating 15 minutes, it again blew with increased violence for two hours, and then abated. The sun set clear, with pleasant weather, at which time not a cloud was to be seen in the western horizon.

At Bombay Hook, near the mouth of the Delaware River, the gale blew from N. N. E. to W. N. W.

At sea, 40 miles N. E. of Cape May, the gale was at S. E., and lasted 8 hours.

At Philadelphia, the storm commenced at 1 P. M. on the 3d, from N. to E., and raged with great violence from N. E. to N. W., during the greater part of the afternoon.

At Trenton, N. J., the gale commenced at 3 P. M., with the wind from N. E.

In lat 39° 20′, lon. 73° 30′, the gale blew from E. S. E. to S. S. E., and continued 8 hours.

At New York, the gale was from N. E. to E., and commenced blowing with violence at 5 P. M., continued with great fury for three hours, and then changed to W. More damage was sustained in 2 hours than was ever before witnessed in the city, the wind increasing during the afternoon, and at sunset was a hurricane. At the time of low water, the wharves were overflowed, the water having risen 13 feet in one hour. Previous to the setting in of the gale, the wind was from S. to S. E., but changed to the N. E. at the commencement of the storm, and blew with great fury till evening, and then shifted to the westward.

At the quarantine, Staten Island, the wind was reported as E. S. E. Other accounts fix it at E.

At Bridgeport, Conn., the gale commenced violently at S. E. at 6 P. M.,

and continued till 9 P. M., then shifted to N. W., and blew till nearly 11 P. M.

At New London, the gale was felt from 7 P. M. to 12 at night.

On the coast of Rhode Island, between Point Judith and Watch Hill, gale from the S.

At Middletown, Conn., violent from S. E. for 5 hours.

At Hartford, commenced heavy from S. E. at 7 P. M.

At Springfield, Mass., violent from 9 to 12 P. M., then changed to the westward.

At Northampton, from S. E. on the same evening.

At Worcester, Mass., in the night between the 3d and 4th of Sept.

At Boston, the gale commenced at 10 P. M., but does not appear to have been severe.

At the time the storm was raging with its greatest fury at New York, the citizens of Boston were witnessing the ascent of a balloon, and the æronaut met with little or no wind. The general course of this storm, northward of Cape Hatteras, appears to have been from S. S. W. to N. N. E., and of its further progress we are uninformed.

It appears, from the foregoing statement of facts, that this storm, previous to its reaching Long Island, extended but a moderate distance inland, and that its influence seaward from the east, was almost equally limited; that between these boundaries it maintained a regular progress along the coast from a great distance towards the south, and probably even in the neighbourhood of the West India Islands;—that this progress, though slower in the lower latitudes, was, after reaching the American coast, at a rate not greatly differing from 30 geographical, or nautical, miles per hour, which is presumed to have been nearly the velocity of the direct southerly current prevailing in the atmosphere at that time, at a medium height from the surface at this rate of progression, appears to have governed the duration and termination of the storm at each place over which it passed—that on the western margin, or verge, of the storm, or at those places most distant from the sea, the wind was north-easterly or northerly, while on the opposite verge, at sea, the wind was southerly and westerly;—that along the central portion of the tract, the storm was violent from the south-eastern quarter, *changing suddenly to an opposite direction;**—and that there was previously and subsequently no prevalence of an easterly wind, nor was there any other apparent cause for a direct movement of the atmosphere from that quarter; all the existing tendencies being in another direction. The centre of the storm, or hurricane, appears to have been generally outside the coast, till, reaching Long Island, it crossed the same, and entered upon the state of Connecticut. It seems also to have passed westward of New Haven, and to have entered the valley of Connecticut river near Middletown, and after partially following that valley for some distance, and crossing the state of Massachusetts, the storm must have disappeared towards the eastern coast, and its further progress does not appear to have been reported. The general analogy or correspondence of the foregoing facts to the known phenomena of whirlwinds and tornadoes, will, it is believed, be sufficiently evident, at least so far as the difference in the magnitude and other circumstances of these rotative masses will permit of the resemblance."

* It is remarkable that not one instance is to be found in this storm in which the wind changed suddenly round to N. W., where it set in from S. E. (See p. 149. 4th.)

Facts collected by Mr. Espy, taken from the newspapers of the time.

Aurora, Sept. 10, 1821.

Norfolk, Sept. 4th.

Among the rest of our misfortunes, we are grieved to state that our town was visited on *yesterday* by a storm or tornado, &c. The morning was dark and gloomy, at 6 o'clock rain began to fall in torrents. At 10 it abated a few minutes, and then came again with increased violence, and the wind commenced blowing a heavy gale from the N. E., and continued to increase to an alarming height. From 11½ to 12½ o'clock, the fury was such as to threaten a general demolition, &c. About 12, the wind shifted to N. W., and continued its fury until half an hour after, and the storm began to subside. At 4 o'clock, the wind changed to S. W., and the weather became calm.

New York, Sept. 4th.

From Saturday (the 1st) till 4 o'clock, we were visited with repeated showers, accompanied with thunder and lightning. The wind veered and shifted to almost every point.

National Intelligencer, Sept. 8.

At New Haven, the gale commenced at 6 P. M., and from 8 to 10 increased to a violent tornado.

National Intelligencer, Sept. 10. Steamboat Norfolk left Baltimore on the 3d, at 9½ A. M., wind at the time light N. W., with rain. At 2 P. M., off Poplar Island, about half way from Baltimore to the mouth of the Potomac, commenced a most tremendous gale from N., with heavy rain, which continued to increase in violence till 4, when it moderated, and at 12 at night, off the mouth of the Potomac, took in tow the ship Repeater, which had left Annapolis at 3 A. M., and at 2 P. M., near Point Look Out, was obliged to cut away all her rigging, the wind blowing a heavy gale from N. E.

National Intelligencer, Sept. 12. Capt. Crabtree, 25 leagues to the S. by E. of Cape Hatteras, says, that on the night of the 2d, a violent gale came on to blow from E. S. E., and began to abate at noon of the 3d. The Franklin Gazette, Philadelphia, says the wind at New York had been S. and S. E. most of the day, but between 4 and 5 it changed to N. E., and blew until near 7 with great violence. About that hour the wind abated, and soon after shifted to W. N. W.

Sept. 6, same paper. Steamboat Connecticut at New Haven, had the wind first from E., but at 10½ o'clock it got round to S. Sept. 7, at New Brunswick, tremendous storm from N. E., with torrents of rain in P. M.

National Gazette, Sept. 8.

Capt. West, of the ship Tuscarora, got under weigh from New Castle at 7 A. M., wind N. E. About 10, came on to blow fresh, with very thick weather and much rain. At 11, came to anchor in Bombay Hook Roads. The wind and rain increased to a violent gale. About 3 began to drift. The wind commenced N. E., and the strongest was from N. At 6 it veered to N. W., moderated and cleared up.

Same paper, Sept. 10. Schooner Gen. Green, between Capes Sable and Ann, had a strong breeze, but no gale, though every vessel in Quarantine Roads (Boston) dragged anchor.

Freeman's Journal, Sept. 8.

Schooner Swan, in lat. 39° 20′, (Evening Post, of 7th, says lat. 36° 20′) lon. 73° 30′, encountered the hurricane, which continued for 8 hours, E. S. E. to S. S. E. Also sloop Regulator, in lat. 38° 30′, lon. 74° 30′, experienced.

experienced a tremendous gale from S. by E., and lay to 10 hours. At Huntingdon, L. I. at 7 P. M., we were visited by a most tremendous gale of wind from the N. E.

Freeman's Journal, of Sept. 11. Ship Repeater, near Point Look Out, had wind from N. E. From 12 to 2 a most violent gale, (Delaware Bay.)

Freeman's Journal, Sept. 11. Schooner Rising States, 2 days from Charleston towards New York, had a violent gale which lasted 6 hours, from S. E. to W. S. W.

New York Evening Post, Sept. 4. The gale at Jersey City was from N. E., accompanied with hail and rain, which fell in torrents.

Sept. 5. At Quarantine, the commencement of the gale was E. S. E.

Sept. 10. Schooner Polly and Sophia, 40 miles N. E. of the Capes of the Delaware, experienced a most tremendous gale from the S. E., which lasted eight hours.

American Daily Advertiser, Sept. 6. From New York of Sept. 4. About 4½ P. M., yesterday, the wind came out from about E., with all the fury of a hurricane, and continued till about 8½ P. M.

Sept. 7. From Norfolk paper of the 4th. Yesterday, between the hours of 10 A. M. and 1 P. M., our town was visited by a hurricane, accompanied by torrents of rain, commencing from N. E. and terminating at N. N. W. Also, from the Bridgeport (Conn.) Farmer. After 2 or 3 days of dull cloudy weather, with frequent heavy showers, we were, on Monday evening, (3d) visited by the most dreadful hurricane which has been experienced for many years. The wind commenced blowing hard from S. E. about 6 P. M., accompanied with rain, and continued to increase in violence till about 9 P. M., when the tempest raged with a degree of fury the most awful and destructive. The storm continued with unabated force until near 11 P. M., when the wind hauled round to S. W., and gradually subsided.

Also, in a letter from New Haven, by a gentleman who left there at 6 P. M., in steamboat Connecticut: "As we approached the light house at the harbour's mouth, the wind, which had been blowing very hard, became violent, and we anchored in the Cove, between the Fork and light house. The gale kept increasing, and our vessel dragged her anchors, in spite of a great scope of cable and the assistance of the engine. Suddenly the wind shifted to S. W., and blew a perfect hurricane. Also, from New York American, Sept. 3d, 1821. In the early part of the day, and at intervals till late in the P. M., heavy showers, with steady breezes from the S. E. From 5 to 6 P. M., the wind and rain increasing, with every indication of a settled storm. From 6 to about 7h. 30m., P. M., the wind E. S. E., but varying to E. and E. N. E., accompanied with rain; blew with extreme violence. From 7h. 30m. to 8 P. M., the wind had much abated; it then veered round to the S. W., and the clouds were swept away with astonishing quickness. Bar. lowest at 7.30—29.34, having been in the mor. at 6h. 30.13 inches.

Poulson, Sept. 10. Dennis' Creek. On the 3d inst. the wind came on to blow about 2h. from the eastward, and continued to increase until about 5 P. M. At about 5, the wind changed to the westward, still blowing very heavy (near Goshen Creek and Maurice River.) Poulson, Sept. 5, at Philadelphia, a storm of rain commenced about 1 P. M. on the 3d, accompanied with high wind, which increased almost into a tornado in P. M. The wind was generally from N. to N. E., during its greatest fury, but varied occasionally to almost every point of the compass. . . . . . Much damage was done at the Navy Yard, by the violence of the gale during its rage from the N. E. and N. W.

Poulson, Sept. 8. Mr. Guille ascended in his balloon at 4h. 45m., at Boston, and sailed towards the N. W. Sept. 10. On Monday night, 3d, a short but severe gale from the S. E, did considerable damage to the trees and fruit in that vicinity; and at Worcester, Mass., the gale commenced at 9 P. M., and increased till midnight; and at Middletown lasted 5 hours; and the New York Evening Post of Sept. 7, says that this gale at Middletown was from S. E., commencing about 9 P. M., and at Boston at 10 P. M. And the same paper says that the rains were very great at Baltimore and Annapolis.

National Gazette, Sept. 6. The gale of 3d Sept. was almost a hurricane at Bombay Hook for about an hour, from N. E. to N. N. W.

Sept. 7. At Cape May, from 1 P. M. till half past 4, the wind blew a violent hurricane S. E. Hugh's large house had the piazza blown off.

Freeman's Journal, Sept. 11. At Annapolis, at 4 A. M., wind W. N. W. and rainy. At the mouth of the Patuxent, at 11h. 30m., gale increasing and inclining northward. At Point Lookout, still inclining to N. E., and at 2 P. M. very violent N. E. At 6 P. M. the gale had abated.

Same paper, Sept. 12. About 5 miles below Reedy Island, at noon, the wind hauled to N. E. from the S. E., and hauled round to N. N. W., blowing a heavy gale. (Delaware Bay.)

Same paper, Sept. 15. Brig Panopea, 75 miles S. by E. from Cape Hatteras. It came on to blow a gale from E. S. E. on the night of the 2d. On the 3d, at noon, the gale began to abate. Also, the Atalanta, off Cape Hatteras, experienced a severe gale from S. E. At Ocracoke, at daylight, wind E. S. E., blowing a gale; after hauling round to S. S. W., ceased between 10 and 11 A. M., both at Ocracoke and Portsmouth.

To the Joint Committee. J. P. Espy.

I will now add, that the reader will perceive, by a careful examination of all these facts, that all the generalizations given above are fairly deduced—and that they all, when combined, form a most satisfactory demonstration of the theory advocated and developed in the preceding papers. Moreover, as the wind on the S. E. side of the storm had been blowing all day, before the storm came on, from the S. E., and on the N. W. side of the storm from the N. W., there appears no reason for the motion of the storm from the S. W., but the uppermost current of the atmosphere, which is known to be almost always moving in this direction.

Date. 1821.	Thermometer. Sun rise.	Thermometer. 2 P.M.	Thermometer. 10 P.M.	Barometer. Sun rise.	Barometer. 2 P. M.	Barometer. 10 P. M.	Rain. inches.	Wind. Sun rise.	Wind. 2 P.M.	Weather.		
Sept. 1	70	82	73	30.02	30.03	30.02	.78	S.	S.	Cloudy.	Broken R.	Cloudy
2	70	78	71	.02	29.97	29.97	.62	S.	S.	do. R.	Cloudy R.	do.
3	70	80	70	29.97	.92	.47	.72	S.	S.E.	do. R.	do.	do.
4	68	73	68	.90	.85	.81		S.		Broken	do.	do.
5	62	75	62	.73	.74	.76		W.	S W.	Clear.	Clear.	Clear.

"On the evening of the 3d, between 7 and 12 P. M., the most violent storm of wind occurred that has happened since 1815." During the evening, Mr. Herrick thinks the wind was from S. E. to S.

These observations, made at New Haven, Connecticut, are furnished by Charles Rich, Esq. of that place.

Philadelphia, March 13th, 1839.

(TO BE CONTINUED.)

A Plan proposed by Capt. F. Beaufort, *Hydrogapher of the British Admiralty, for Improving the manner of keeping the Log on board of Vessels at Sea.*

Capt. Beaufort has suggested the following plan for keeping the log on board of vessels at sea, viz:

1st. The state of the weather to be denoted by letters of the alphabet, 18 in number, each letter showing the variety.

2nd. The force of the wind to be denoted by figures; 13 degrees to be used, beginning with *calm* and ending with *hurricane*. Each figure to denote a degree.

It will only be necessary to rule the log-book with two columns, one for each class.

Much space, time, and labor will be saved, and much valuable information gained and preserved by an adoption of this method of recording observations. V.

1st Column to Record the force of the Wind.

0	denotes	Calm.		
1	"	Light Air.—just sufficient to give steerage way.		
2	"	Light Breeze,	with which a well-conditioned man-of-war, under all sail and clean full, would go, in smooth water, from	1 to 2 knots.
3	"	Gentle Breeze,		3 to 4 knots.
4	"	Moderate Breeze,		5 to 6 knots.
5	"	Fresh Breeze,	in which the same ship would just carry, close-hauled.	Royals, &c.
6	"	Strong Breeze,		Single reefs and top-gallant sails.
7	"	Moderate Gale,		Double reefs, jibs, &c.
8	"	Fresh Gale,		Triple reefs, courses, &c.
9	"	Strong Gale,		Close reefs & courses.
10	"	Whole Gale,	in which she could only bear,	Close-reefed main topsail and reefed foresail.
11	"	Storm,	with which she would be reduced to,	Storm stay-sails.
12	"	Hurricane,——	to which she could shew——	No canvass.

If the above mode of expression were adopted, the state of the wind, as well as its direction, might be regularly marked, every hour, in a narrow column on the log-board.

2nd Column to Record the state of the Weather.

b denotes Blue sky.—Whether with clear or hazy atmosphere.
c Cloudy.—i.e. Detached opening clouds.
d Drizzling rain.
f Fog.—Thick fog.
g Gloomy dark weather.
h Hail.
l Lightning.
m Misty or hazy.—So as to interrupt the view.

o denotes	OVERCAST.—i. e. The whole sky covered with one impervious cloud.
p	PASSING SHOWERS.
q	SQUALLY.
r	RAIN.—i. e. Continuous rain.
s	SNOW.
t	THUNDER.
u	UGLY THREATENING APPEARANCE IN THE WEATHER.
v	VISIBILITY OF DISTANT OBJECTS.—Whether the sky be cloudy or not.
w	WET DEW.
•	Under any letter denotes an EXTRAORDINARY DEGREE.

By the combination of these letters, all the ordinary phenomena of the weather may be recorded with certainty and brevity.

Examples.

d e m	Blue sky, with detached opening clouds, but hazy round the horizon.
g $\underset{\bullet}{v}$	Gloomy dark weather, but distant objects remarkably visible.
$\underset{\bullet}{q}$ *p d l* $\underset{\bullet}{t}$	Very hard squalls, and showers of drizzle, accompanied by lightning, with very heavy thunder.

Civil Engineering.

CONVENTION OF CIVIL ENGINEERS OF THE UNITED STATES.

Proceedings of the Convention of Civil Engineers, for the formation of a Society of Civil Engineers of the United States. Held in Baltimore, Maryland, February 11, 1839.

In pursuance of a call from Augusta, Ga., a meeting of civil engineers was held at Barnum's Hotel, in the city of Baltimore, on Monday, February 11th, 1839.

On motion of Mr. J. Edgar Thomson, of Georgia, Isaac Trimble, Esq., of Baltimore, was called to the chair.

The chairman having called the convention to order, laid before it the following letter from the curators of the Maryland Academy of Science and Literature.

"To ISAAC TRIMBLE, Esq.,

Dear Sir:—The undersigned having been informed that a number of gentlemen, from various parts of the Union, are now in the city, for the purpose of forming an Association of Civil Engineers, beg you, in the name of the Academy, to offer their rooms for the use of the gentlemen interested in a project so intimately connected with the advancement of science.

Yours, with great respect,

JAMES GREEN,

For the Curators of the Maryland Academy of Science and Literature."

Whereupon, on motion of Mr. C. O. Sanford, of Virginia, the convention adjourned, to meet at that hall, to-morrow morning at 11 o'clock.

HALL OF THE MARYLAND ACADEMY OF SCIENCE AND LITERATURE,
11 *o'clock*, *Tuesday*, *February* 12*th*, 1839.

The convention met according to adjournment, forty gentlemen of the profession being present, from the States of Massachusetts, New York, New Jersey, Pennsylvania, Illinois, Maryland, Virginia, Missouri, North Carolina, Georgia and Louisiana.

The convention being called to order by the chairman of yesterday, Mr. J. F. Houston, of Pennsylvania, was appointed Secretary.

The chairman then read a letter from Wm. G. McNeill, Esq., expressing regret at not being able to be present at the meeting of the convention.

A letter of similar import from Jonathan Knight, Esq., was read by Mr. Latrobe.

The chairman having announced that the convention was prepared to go into election, on motion of Mr. Miller, Mr. Latrobe was unanimously chosen President.

The President having announced that the convention was organized, Mr. Kneass offered the following resolutions:

1. *Resolved*, That the convention now proceed to the election of a committee of *seventeen*, to prepare and adopt a constitution, and form a Society of Civil Engineers of the United States.

2. *Resolved*, That the committee meet at the Hall of the Franklin Institute, in Philadelphia, at such time as they may deem convenient; and that five of them shall constitute a quorum for the transaction of business.

The first resolution being before the convention, Mr. Pickell proposed the following amendment, to be added;

"And that in the selection of the members of the committee, not more than *two* be taken from each State or Territory in the Union."

At the request of Mr. Sykes, Mr. Pickell withdrew his amendment, to give way to an amendment by Mr. Trimble, which was "to strike out the number *seventeen* and insert *ten;*" which was lost. The yeas and nays being called for, stood yeas 14, nays 22.

Mr. H. A. Wilson then proposed to amend by "striking out *seventeen* and inserting *five;*" which amendment was lost.

Mr. Trimble moved to amend by "striking out *seventeen* and inserting *twenty;*" which was also lost.

Mr. Pickell then renewed his amendment.

Mr. Miller proposed to amend the amendment so as to read;

"And that, in the opinion of this convention, the said committee should be so selected, that all the different portions of the Union may be represented in it, so far as is practicable;"

Which was concurred in, and the amendment so amended adopted.

The question being on the first resolution as amended, it was adopted.

The second resolution being before the convention, an amendment was proposed by Mr. Miller, and accepted by Mr. Kneass, specifying "the second Wednesday in April as the time of meeting."

Mr. Trimble proposed to amend by striking out all after the word "Philadelphia," and inserting, "at as early a day after the adjournment of this convention, as will suit their convenience; and that ten of their number constitute a quorum for business," which amendment was not agreed to.

Mr. Harrison then moved to amend by adding, "but that a majority of the seventeen, expressing their assent by letter or otherwise, be required to adopt the constitution," which was concurred in, and

The question being upon the second resolution as amended, it was unanimously carried.

The convention then went into the election called for by the first resolution, pending which, the convention adjourned to 4 o'clock, P. M.

Afternoon Session.

The President announced to the convention the result of the balloting, being the election of the following gentlemen,

Benjamin Wright,	of New York.
William S. Campbell,	of Florida.
Claude Crozet,	of Virginia.
W. M. C. Fairfax,	of do.
C. B. Fisk,	of Maryland.
Edward F. Gay,	of Pennsylvania.
Walter Gwynn,	of North Carolina.
J. B. Jervis,	of New York.
Jonathan Knight,	of Maryland.
Benjamin H. Latrobe,	of do.
W. G. McNeill,	of South Carolina.
Edward Miller,	of Pennsylvania.
Moncure Robinson,	of Virginia.
J. Edgar Thomson,	of Georgia.
Isaac Trimble,	of Maryland.
Sylvester Welsh,	of Kentucky, and
G. W. Whistler,	of Connecticut.

It was then, on motion of Mr. S. W. Roberts, unanimously resolved,

"That in recording the minutes of the proceedings, the secretary be directed to place the name of Benjamin Wright, at the head of the list of the committee, he having been elected by an unanimous vote of the convention; and that the names of the other gentlemen be made to succeed in alphabetical order."

Mr. Kneass laid before the convention the following letter from the President and Managers of the Franklin Institute of Pennsylvania.

HALL OF THE FRANKLIN INSTITUTE,
Philadelphia, January 2d, 1839.

"To BENJAMIN WRIGHT, WILLIAM STRICKLAND, SAMUEL H. KNEASS, E. H GILL, Esquires, and other Civil Engineers.

Gentlemen:—Your communication* of the 24th ult., addressed 'to the President and Managers of the Franklin Institute of the State of Pennsylvania,' was read at a special meeting of the Board of Managers, held on the 31st ult., and was referred to a committee consisting of the undersigned, who were instructed to confer with you, in relation to the project, entertained by you, of forming an 'Institution of American Civil Engineers.' The committee were authorized to take order on the subject referred to them; and to express the anxious desire of the Institute to promote any

* TO THE PRESIDENT AND MANAGERS OF THE FRANKLIN INSTITUTE OF PENNSYLVANIA.
Philadelphia, December 22d, 1838.

GENTLEMEN,—A meeting of engineers having (by a circular from Augusta, Georgia, dated December 17th, 1838,) been called in Baltimore, Maryland, the *second Monday in February next*, for the purpose of forming an Institution of American Civil Engineers, and the undersigned being of opinion that such an institution if attached to the Franklin Institute would prove beneficial to that institution, while the primary

plan, that might appear to you best calculated to insure the success of your undertaking.

"After the free conference, which our committee had yesterday, with several of your number, we think we will best attain the objects you had in view in your application, and best consult the wishes of our own Board, by the following answer to your letter:

"Should the Civil Engineers of the United States concur in the formation of a society such as you propose; and should they decide to meet in this city, the Franklin Institute will agree:

"1st. To furnish them all the accommodations they may desire, for the meetings of their society, or of its committees, and for their collections of books, drawings, models, &c. The details of this arrangement will be entered into, whenever it is known what extent of accommodation may be required, and a joint committee of the two bodies will have power to carry into execution all the regulations, in regard to the arrangement, disposal, and care of your books and collections, which your society may adopt.

"2d. The Franklin Institute will authorize their Actuary to accept any appointment, as secretary and treasurer, librarian, or curator, which the Society of Civil Engineers may choose to bestow upon him. Any arrangement made by the Society with the Actuary, which will be satisfactory to

objects of the other would perhaps be more speedily accomplished by such a connexion, on account of the Institute having already the buildings, and also a good library on engineering: are led to propound to you the following queries.

Should an Institute of Engineers be formed, would the Franklin Institute furnish suitable accommodations?

Would the Actuary of the Franklin Institute be permitted to act as Secretary and Treasurer to the Institution, and take charge of the books and documents, if he were willing to accept the office for a suitable compensation?

If the convention at Baltimore, or any subsequent one, should desire, would the Managers of the Franklin Institute admit the members of the Institution of Civil Engineers into their institution as an adjunct association, with liberty of secession, if it should subsequently appear that the objects of the Engineers' Institute could not be thus attained? And could the Managers by law make such a union effective under their charter, and upon what conditions?

Finally, as the object of this communication is to obtain from the Managers of the Franklin Institute their views upon the formation of an association likely to be of such advantage to science and the arts, (the same cause in which you are engaged,) as it is confidently expected an institution of Civil Engineers will prove to be, the undersigned would feel themselves obliged to the Managers of the Franklin Institute for any suggestions calculated to advance the prosperity of the Institution they have in contemplation, and which, from the experience of the Managers of the Franklin Institute, it appears to the undersigned they are well qualified to give.

Very respectfully,

BENJAMIN WRIGHT,
WILLIAM STRICKLAND,
SAMUEL H. KNEASS,
E. H. GILL,
H. R. CAMPBELL,
ELLWOOD MORRIS,
C. O. SANFORD,
W. MILNOR ROBERTS,
W. H. WILSON,
EDWARD MILLER,
S. W. ROBERTS,
ASHBEL WELCH,
E. A. DOUGLAS,

} *Civil Engineers.*

both, will be concurred in by the Institute. Should the duties thrown upon him, as the executive officer of the new society, consume too much time, he may (while he remains the responsible officer of both institutions) take such assistants, as may be necessary.

"3d. The Journal of the Franklin Institute will be open to the Society of Engineers, as a vehicle of information to their scattered members; and the committee on publications will cheerfully avail themselves of the privilege of selecting, for publication in our Journal, any memoir of interest, or any communication which you may not be able to include in your annual volume of Transactions.

"4th. Should the society of engineers deem it desirable, to entrust any part of their business, such as the selection of materials for their transactions, or the superintendence of their publications, to a committee of the managers of the Franklin Institute; such a committee will be appointed by our Board, and will freely give you any assistance, advice and services, that may be required.

"The charter, under which the Franklin Institute is organized, is one of a most liberal character. The objects of the corporation are stated to be (among other things) the promotion and encouragement of the useful arts, by all such measures, as they may deem expedient, and the corporation has all the powers necessary to justify the adoption of any measures, conducive to the objects of your society, which you may be disposed to request of them.

"We have pleasure in adding, that admittance to our rooms and collections, and, indeed, all the privileges of membership are cheerfully extended, on all occasions, to strangers visiting our city, and that therefore any engineers, arriving here, would be always welcome visiters at the Franklin Institute.

We know the views of our Board, and feel ourselves authorized to pledge to you the fullest and most friendly co-operation on the part of the Institute, should you select Philadelphia as the location of your society."

William H. Keating,
Samuel V. Merrick,
John C. Cresson,
Robert M. Patterson,
Charles B. Trego.
} *Committee.*

Whereupon, on motion of Mr. Griffin, it was resolved, that the thanks of this convention be tendered to the President and Managers of the Franklin Institute, for their liberal proposition.

Mr. Roberts then introduced the following resolution:

Resolved, "That the thanks of this convention be tendered to the Maryland Academy of Science and Literature, for their courteous offer, to the convention, of their rooms in Baltimore,"—which was unanimously concurred in.

Mr. Trimble then moved, that the President be requested to notify the members of the committee, not present at the convention, of the proceedings; which motion was adopted.

On motion of Mr. Thomson, of Georgia, it was *Resolved*, That the President appoint a committee of five to draft an address to the Civil Engineers of the United States, and to superintend the publication of such portions of the proceedings of this convention as they may deem expedient. The President appointed Messrs. Fisk and Trimble, of Maryland, S. W. Roberts,

of Pennsylvania, J. B. Jervis, of New York, and G. W. Whistler, of Connecticut.

Mr. C. O. Sanford then moved, that the thanks of this convention be tendered to the chairman of the preparatory meeting, and to the President and Secretary of the convention, for the able and efficient manner in which they have discharged their duties; which was concurred in; and the convention adjourned sine die.

BENJAMIN H. LATROBE, *President.*

John Frederick Houston, *Secretary.*

Address of the Committee appointed at the Convention of Civil Engineers, which met in Baltimore, February 11, 1839.

At a Convention of Civil Engineers of the United States, which met in Baltimore on the 11th of February last, in pursuance of a call from a highly respectable meeting of members of the profession in Augusta, Geo., the following resolution was adopted.

Resolved, That the President appoint a Committee of Five to draft an address to the Civil Engineers of the United States, and to superintend the publication of such portions of the proceedings of this Convention as they may deem expedient.

The President appointed Messrs. Fisk and Trimble, of Maryland, S. W. Roberts, of Pennsylvania, J. B. Jervis, of New York, and G. W. Whistler, of Connecticut. Mr. Whistler having declined the appointment in consequence of his inability to attend, Mr. Edward Miller, of Pennsylvania, was subsequently appointed in his place.

A majority of the Committee met, according to appointment, at the Hall of the Franklin Institute, in Philadelphia, on the 20th of March, 1839, and adopted the following address.

ADDRESS.

The Committee believe that they will best perform the duty assigned to them, of preparing an address to their professional brethren upon the subject of the proposed Society of American Civil Engineers, by confining their remarks to what they deem the objects and advantages of such an institution.

Forty members of the profession, from eleven states of the Union, composed the Convention at Baltimore, and a number more expressed, through their friends who were present, their approbation of the object in view, and their regret at being unable to attend.

The principal business transacted by the Convention was the election of seventeen Engineers, from different parts of the Union, as Delegates to frame a Constitution and form a Society. The time fixed for this meeting was the second Wednesday in April next, and the place the Hall of the Franklin Institute, in Philadelphia.

A gratifying degree of unanimity characterized the proceedings of the Convention, and a confident hope was generally expressed that the Delegates (many of whom were not present) would form a Society, the obvious utility of which would secure its perpetuation.

Public works are now so extended in our country, and the mass of experimental knowledge to be gained from those in use is so great and so peculiarly applicable to our circumstances, that it is even more valuable to

the American Engineer than what he can learn in Europe, where larger means have permitted greater expenditures. In this country, it is of paramount importance to obtain the greatest amount of useful effect at the smallest cost; and of attempts to attain this end, the Union now contains a multitude of instructive examples. Some have been eminently successful, and others less so; but of either kind, the student, or the more advanced Engineer, too often seeks in vain for any satisfactory written or printed description, and is unable to obtain any thing more than vague, doubtful, and incorrect information. This evil can only be removed by the exertions of the Engineers themselves.

They are now established as a distinct class, and have long felt the want of such an association as that proposed, but it has hitherto been supposed that the proper time for its organization had not yet arrived.

The success that has attended the labours of the London Institution of Civil Engineers, its high standing and great usefulness, prove that such societies may be of great public utility, when properly conducted, and are incentives to induce us to imitate so excellent an example.

It is admitted, however, that a society in this country must differ somewhat in its plan of operations from the British Institution, which can readily give utterance to its opinions elicited after frequent and full discussion, since a large portion of its members during the winter, have their residences within the limits of London. Here, however, owing to the vast extent of territory over which are scattered the members of our profession, the usefulness of the Society must (for the present at least) depend more upon the facts and experience of its members, made known in written communications, than upon their opinions orally expressed in public discussions.

The very fact that our improvements are so widely spread, that few, if any, members are able to give even the most important of them a personal examination, affords, perhaps, the strongest argument in favour of a society that shall, by a concert of action, bring the experience of the whole country within the reach of each member.

The difficulty of meeting at any one point, caused by the time and expense required in traveling from distant portions of so extensive a country as the United States, is a serious obstacle, but it has been much diminished by the facilities afforded by the rail-roads already in use, which are among the valuable results of the labours of our Civil Engineers.

Though our Society may be less favourably situated than the one in London for frequent and public discussion, we nevertheless anticipate many important advantages to be derived from a personal intercourse and interchange of information among its members, and from the establishment of a permanent repository of the results of experience, obtained from the most authentic sources.

The standing of the profession in our country is, fortunately, such that its importance need not be dilated upon; it is, therefore, the more necessary that every thing in the power of the members should be done to add to its respectability and increase its usefulness. We look forward to the formation of the Society as a valuable means of advancing these desirable ends.

We think that the preliminary steps have been well taken; and as the late Convention has given the whole matter into the hands of the seventeen Delegates who were elected to frame the constitution and form the Society, we hope that each of those gentlemen will feel that an important and complimentary trust has been reposed in him, and exert himself to fulfil it in

such a manner as to advance the permanent interest of the profession of which he is a member.

We trust, also, that each may appreciate the importance of attending at the time and place appointed for forming the Society, and will be willing to make some sacrifice for effecting that object; or if prevented from attending by uncontrollable circumstances, that he will express his views in writing upon the subject of a suitable constitution.

The Committee will close this address by a quotation from the inaugural address of the distinguished Thomas Telford, the first President of the London Institution, which appears to them peculiarly appropriate.

"In foreign countries similar establishments are instituted by government, and their members and proceedings are under its control, but here a different course being adopted, it becomes incumbent on each individual member to feel that the very existence and prosperity of the institution depends, in no small degree, on his personal conduct and exertions; and the merely mentioning the circumstance will, I am convinced, be sufficient to command the best efforts of the present and future members, always keeping in mind that *talents and respectability are preferable to numbers, and that from too easy and promiscuous admissions, unavoidable and not unfrequent incurable inconveniences, perplex most societies.*"

Signed by order of the Committee.

Charles B. Fisk, Chairman.

Sixth Annual Report to the Building Committee of the Girard College for Orphans. By Thomas U. Walter, *Architect.*

Gentlemen—

In conformity with your Resolution of the 5th instant, I have the honour to lay before you the following Report on the progress of the work during the past year.

The arches over the rooms in the third story of the main building are entirely finished,—the marble work of the *cell* is completed,—the columns and architraves of the south vestibule, to the third story rooms, are erected and prepared to receive the vaulting to support the roof,—and those of the north vestibule are so far advanced as to admit of their being completed during the winter. The centres are all prepared for these vestibules, so that the arches may be constructed early in the ensuing season.

The centres, or supports upon which the third story arches were formed, have been removed,—those in the second story are freed from the brick-work, and the workmen are now engaged in taking them out,—and those in the first story were removed in the early part of the season:—we have, therefore, the satisfaction to know that all the large arches are completed, and are now standing independent of the supports upon which they were constructed, without having produced the slightest fracture or settling in any part of the building. I am induced to make these remarks from the fact, that the great length of the *chord* of the arches in the first and second stories, compared with their small *versed sine*, led many to doubt the possibility of making them permanent. Although such apprehensions were most certainly never indulged by those who are conversant with the theory of arches, it still becomes necessary for me to lay the result before you, as the subject was one that was freely discussed in the early part of the work.

It will also be proper for me here to advert to the mechanical construction

of these arches;—they are all composed of hard burnt paving bricks, and mortar made of lime, hydraulic cement, and sharp sand:—the bricks were all dipped in water before they were laid, and the mortar was used in very small quantities, few of the joints being more than one-eighth of an inch in thickness:—the keys are all formed of marble, and were fitted to their places by the stonecutters after the completion of the brickwork; these keys are four inches wide at the bottom and six inches at the top. Notwithstanding the versed sine of these arches is but eight feet and a half, while they each cover a room of fifty feet square, and contain 117,000 bricks, the weight of which is nearly *three hundred tons*, there was no sinking at the crown of any of them, when the centres were removed, beyond one-eighth of an inch. It was naturally expected that the compressibility of the materials would cause considerable depression, but the excellence of the workmanship has produced an unusual firmness in the work, which reflects great credit upon the superintendent under whose directions it was executed.

The arches over the rooms in the third story being unrestricted as to height, I have given them the form of pedentive domes with semi-circular sections: these arches are constructed with the same degree of care and accuracy as those in the lower stories, and their appearance since the centres have been removed, fully realizes our expectations.

All the columns, on both the flanks, have been commenced; four on the eastern side have been raised to their destined height; one is ready to receive the capital, and three have their architraves upon them; nearly all the marble required for the eastern colonnade is wrought, and the whole will be completed during the winter, so as to be ready to be put together as soon as the spring opens.

A sufficient number of column blocks are prepared to complete seventeen columns, including what are already finished: twelve capitals are entirely completed, and six more are in progress of execution, most of which require very little work to finish them.

There are nineteen architraves on the ground for the exterior portico, besides the two that are placed in their destined situation.

The interior of the out buildings, on the east of the College, have been as nearly completed as may be desirable until Councils decide upon the time for opening the institution. These buildings are so far advanced as to admit of being prepared for occupancy at two or three weeks' notice.

The quantity of marble delivered during the past year, amounts to 35,027 cubic feet.

There are now remaining on the ground, exclusive of the wrought and unwrought materials for the exterior porticoes before alluded to, about 1,600 feet of finished work, 3,040 feet of sawed material, and 1,700 cubic feet of marble in the rough.

The number of bricks left on hand from the previous year amounted to 162,000; since which we have purchased 2,300,150, making 2,165,150; of which 2,075,150 have been used in the building, leaving 90,000 now on the ground.

It is due to the superintendents of all the mechanical branches to say, that the execution of every part of the work continues to merit the highest commendation;—the contracts have been faithfully performed, and nothing has occurred to mar the harmony that has always prevailed on the work, or to impede its progress in the slightest degree.

The expenditures from December 31st, 1837, to December 31st, 1838, amount to $229,937.

The wrought and unwrought materials now on the ground, and which have not yet been used in the building, are worth about $125,000, all of which will be available for the work of the ensuing season.

We have again covered the main building with a temporary roof, and have taken great care to prevent injury from frost; the furnaces have also been put into operation, by means of which every room in the building is kept continually warm.

The precautions that have been used to prevent the arches from being saturated by rain during the execution of the work, and which were spoken of more fully in my last annual report, together with the introduction of heated air by means of the temporary furnaces, have had the effect already to render the walls of the first and second stories perfectly dry: we may therefore proceed to finish these rooms without delay, as no difficulty need be apprehended from dampness.

The main building having advanced so far towards completion, and the two eastern outbuildings being virtually finished, I would respectfully suggest the propriety of extending the work at an early day, so as to embrace all the principal objects that will require to be completed previous to the full organization of the College. The most important of these are, *the two western outbuildings,—the wall to enclose the College grounds, with the lodges and gates of entrance,—and the arrangements for supplying the establishment with water;* which, according to our present plan, will include *a laundry, drying room, ironing rooms, &c.*

As regards the western outbuildings, their foundations may be laid, and the walls carried up as high as the top of the basement in the next season, without interfering at all with the rest of the work; the quantity of marble they will require will be but small, and that will be but plain ashlar. These buildings will require three years to complete them; I therefore think it important to commence them at once;—the expense of progressing as far with them as I have proposed will not exceed $20,000.

The wall to enclose the grounds, together with the lodges and gates of entrance, constitute another of the subjects I have taken the liberty to suggest for your consideration. It having been decided that the will of Mr. Girard can only be carried out by enclosing the whole forty-five acres, it will become necessary to give early attention to the subject. The whole circuit of the ground is 7,200 cubic feet, and (in the words of Mr. Girard) it must "*be enclosed with a solid wall, at least fourteen inches thick and ten feet high, capped with marble, and guarded with irons on the top;*"—in order, therefore, to conform strictly with these injunctions, and at the same time to make the wall permanent and durable, I propose to lay a course of solid granite, about one foot and a half in height, on a substantial foundation of rubble stone, so as to rise about a foot above the surrounding streets; on this granite base I would construct a brick wall, of fourteen inches in thickness, with buttresses twelve feet apart, projecting nine inches at the bottom, and battering to four inches at the top; on the inside I would build spur piers opposite the buttresses, and crown the whole with a massy marble capping surmounted with irons, as directed by Mr. Girard.

The cost of constructing the wall, as I have here suggested, will be $125,000, exclusive of the gates and lodges, which will cost about $20,000 more.

It would unquestionably be more in harmony with the rest of the architecture, to face this wall with marble; the additional expense of which, for the outside alone, would amount to $100,000; if, however, you should de-

cide to execute this part of the work with bricks, we must depend upon paint for subduing such parts of it as most interfere with the design.

In view of the great extent of this wall, I think it important to make an early beginning; I would accordingly recommend that the granite be put under contract immediately, and that arrangements be made to accomplish about one-fifth of the work during the ensuing season: about $25,000 will therefore be required for this part of the work, should you decide to go on with it as I have here suggested.

The plan for supplying the College with water, is also one of the subjects to which I have ventured to invite your attention. I had the honour to lay before you, in May last, a design for the attainment of this object by means of the water power at Fair Mount, and which I have the satisfaction to say, has been fully approved by the Watering Committee of the City Councils.

Inasmuch as it becomes my duty to furnish you with an estimate of the cost of this part of the work, it will be proper for me here to advert briefly to the plan.

The surface of the ground at the base of the main building being 26 feet above the surface of the water in the Reservoirs at Fair Mount, I found it necessary, in making the plan, to include a reservoir to be placed on the College land, of sufficient height to furnish all the buildings connected with the establishment with a full supply of water under a good head. I have, therefore, designed a building, of three stories in height, to be placed on the highest part of the ground west of Schuylkill Front street; the first and second stories of this building will comprise the laundry, drying room, ironing rooms, &c., and the third story will contain the reservoir.

I then propose to attach a small forcing pump to the northern wheel of the City water works, and connect it, by means of iron pipes, with the reservoir at the College; the power thus obtained will be no detriment whatever to the City works, and will doubtless be ample for all the purposes of the College.

The whole cost of this arrangement, including the building for the reservoirs, &c. at the College, will not exceed $35,000, and it should be remembered, that the only expense will be the first cost of the fixtures, as no additional superintendence will be required at Fair Mount in consequence of an additional pump for the College.

Should you decide to execute this plan, about $15,000 will be required during the ensuing season to prosecute the work.

As there are no means at present for obtaining water, other than those afforded by ordinary wells, it is desirable that arrangements be made forthwith for commencing so important an appurtenance to the establishment.

As regards the amount of work that may be done on the main building in the course of the coming season, I would respectfully say that the flank porticoes may both be completed, all the marble tiles for the roof may be wrought, and the brickwork of the cell prepared to receive them; the finishing of the first and second stories may be progressing, and the marble tiles for the floors, the stairways, and other matters connected with the inside finish, may be put in hand immediately.

To proceed thus rapidly with the main building, about $300,000 will be required for this part of the work alone during the season.

Should you, therefore, desire to forward the whole establishment towards completion, with as much expedition as the present state of the works, and the facilities we now have of obtaining materials will admit, the sum of

$372,000 will be required to prosecute the work during the present year, as follows:

For the two western outbuildings	$ 20,000
For the wall around the premises	25,000
For carrying the proposed plan for obtaining water into operation	15,000
For the main building	300,000
And for completing the two eastern outbuildings, and paying what yet remains due upon them	12,000
Making, as before stated, ...	$372,000

In conclusion, I would only observe, that there will be no difficulty in accomplishing all that I have mentioned before the close of the present year; provided we are informed of your decision at an early day, so as to enable us to make the necessary arrangements for materials previous to the opening of the season.

I have the honour to be, gentlemen, with
great respect, your obedient servant,
Thomas U. Walter, Architect.

Girard College, Jan. 21, 1839.
To James Hutchinson, Esq.,
Chairman of Building Committee, Girard College for Orphans.

Mechanics' Register.

LIST OF AMERICAN PATENTS WHICH ISSUED IN APRIL, 1838,
With Remarks and Exemplifications by the Editor.

121. For a *Spring Lock for Coach and Rail-road Car Doors;* Peter Alverson, New Haven, Connecticut, April 2.

We are told, by the patentee, that "the object of his invention is a spring lock easily managed, and of sufficient strength to secure the door firmly, and yet in size and form so compact as not to injure the pillar of the door, nor interfere with the run of the lights, and which may be opened and shut from within as well as from without." The lock is then described, but its construction, although not specially recondite, cannot be made clearly known without the drawings.

122. For a *Rotary Steam Engine;* Oliver Wright and A. A. Wilder, Warsaw, Genesee county, New York, April 2.

This engine consists of a thin, revolving wheel, or drum, to the periphery of which steam is conducted through hollow arms within the drum, extending from its centre to its periphery, where it issues tangentially; the improvement claimed is to "the application of springs and set screws to the apertures of rotary steam engines; and also the placing a door to the case so that the apertures may be closed or opened without taking the case apart."

It is not to minor arrangements, of this character, that the rotary engine will owe its utility, should such a debt ever be contracted by it: they may serve to render one rotary engine better than another, but to enable it to

compete with the reciprocating engine requires a radical change, a mode of construction which shall be absolutely new; *possibly* this may be eventually discovered.

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123. For an improvement in *Wardrobe Bedsteads;* Z. C. Favor, Boston, Massachusetts, April 2.

This bedstead is to have the appearance of a wardrobe when turned up; for this purpose there is to be, below the sacking bottom, framed work in imitation of panel doors, whilst swinging doors are dispensed with; there are, however, pilasters hinged to each edge of the front of the case, which turn back to allow of the bedstead being brought down, and which hide the folding legs when it is turned up. The claim is to "the making the under side of the bedsteads to imitate doors in the manner set forth, there being no doors in the improved wardrobe bedstead."

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124. For an improvement in the *Manufacture of Gunpowder;* Richard J. L. Witty, Lowell, Massachusetts, April 2.

(See Specification.)

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125. For an improved mode of *forming raised surfaces for Printing* on paper, Calico, &c.; Godfrey Woone, City of London, April 2.

(See Specification.)

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126. For an improved *Machine for breaking Hemp and Flax;* Alvin Kyes, Crittenden, Grant county, Kentucky, April 2.

An endless chain of slats, or bars, is made to revolve round two rollers, the bars, or slats, forming the bed of the break. Above this is a platform extending the length and breadth of the break, and having on its under sides projecting slats which are to pass in between those of the revolving apron, but so far apart as to span over two of them. This platform is raised vertically by cams, and falls upon the hemp, which is placed upon the bed above described; the claim is to "the so placing of the slats upon the breaker, at such distance apart as that they shall span over two bars of endless chain, whilst the feeding is to the distance of one bar only; the slats thus striking alternately between each bar, as the endless chain is made to advance."

It does not appear to us likely that this simple device will obviate the difficulties which have been encountered, to a greater or less degree, in all the numerous machines for breaking hemp, &c., that have been contrived and patented; not one of which has fully answered the purpose designed.

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127. For an improvement in the *Plaiting Machine for covering Whips;* Seymour Halliday, Westfield, Hampden county, Massachusetts, April 4.

If the reader has ever seen a machine of this kind at work, he will not require an apology for avoiding all attempts at description, its complexity being such as to forbid it. The general construction of this machine is not different from those in general use, the claims being only to certain minor improvements; these claims would not, if copied, convey any distinct idea, even to one conversant with the machine, unless he had the machine itself or the drawing of it before him.

128. For improvements in the mode of ***building Ships or other vessels;*** Henry Higginson, Boston, Massachusetts, April 4.

In the specification of this patent various improvements are contemplated in ship building, some of which, as will be seen by the claims, are analogous to such as have been essayed, whilst they were believed to be sufficiently different to justify the grant of a patent. It was the intention of the patentee to carry out his plans at an early day, by a practical test, but this has been prevented by his decease, which occurred very shortly after the date of his patent. The claims are of great length, and are as follows:—

Claim.—"Having thus fully described the various improvements made by me, in the manner of building ships, or other vessels, and also, the way in which the same may be carried into effect; I hereby declare that the following are the improvements in this art, which I claim as having been invented by me, and which I desire to secure by letters patent.

"I claim the use of two more courses of planks running longitudinally upon the vessel, arranged in the manner and for the purpose described.

"I claim the employment of diagonal braces placed between the ribs of the vessel, or so placed that the braces themselves may form part of the ribs, and so arranged as to be in contact with the outer planking, or nearly so, that is to say, without any timber, plank, or other substance of considerable thickness, between the said braces and planking, the said braces being at the same time so adjusted that they may be forced hard to their bearings by means of wedges; the whole of which arrangement having for its object the producing a greater degree of inflexibility in the frame than has been ordinarily attained. In making this claim, it is to be understood, that I confine myself to the strengthening of the *hull of the vessel,* by wedged braces between the ribs, or by using braces as a substitute for ribs, a thing which will be readily distinguished from such frame work as has sometimes been used above the deck in certain vessels (as on steamboats for supporting the boilers and other parts of the machinery,) and not, therefore, properly connected with ship building. By referring to the description of such braces in this specification, it will be seen that I do not intend to limit myself to any particular form, or combination, of them, but to vary this and the material employed, as I may think proper, whilst the plan and object remain entirely the same.

"I claim the *combination* of two, or more, courses of planking outside the frame, with the use of diagonal braces of any form, or material, believing such a combination to be new and eminently conducive to both strength and lightness.

"I claim the use of one, or more, bands of timber, surrounding the vessel horizontally, or nearly so, and employed in the manner, and for the purposes, set forth.

"I claim the employment of iron bands passed over and under the upper and lower horizontal bands of timber, as a substitute for such ties of timber as I sometimes use, for the purpose of resisting and sustaining the force of the wedges employed with the diagonal braces, as described.

"I claim the double rebate along the keel, and the stem and stern posts, to receive the double planking, and to allow the outer layer of plank to overlap the inner layer, which said double rebate and double planking may be used with or without any other improvements herein described.

"I claim the use of diagonal braces sloping up from the keel, or keelson, to the ends or centre of the deck beams, or to the side timbers of the vessel,

or to the stem or stern posts, in the manner, and with the intention, herein made known.

"I claim the manner of using one or more ranges of stout timber between the floor timbers, running lengthwise of the vessel, and so constructed as to be wedged up, whether used alone, or in combination with dovetailed ties, uniting and bracing the deck beams, in order to prevent hogging, as described.

"I claim the use of plank, grooved in the manner described, for receiving the deck beams, and thus add strength to the upper works, generally.

"I claim, also, the employment of the system of wedging, not only as applied to my diagonal braces, but to braces of any form, or material, or to any other part of the ship's frame, as being the best and most convenient method of forcing all parts to their bearings, and thereby producing a great degree of firmness and inflexibility, which I hold to be essentially necessary in this sort of structure. I do not claim the use of wedges in the art of ship building generally, but I limit my claim to the use thereof for the purpose of stiffening the frame in all its parts, and as stationary appendages thereto."

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129. For an improved *Draft Box for Steam Engines;* Andrew M. Eastwick, city of Philadelphia, April 5.

(See Specification.)

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130. For a mode of forming a *Spiral flue for Steam boilers;* Benj. J. Miller, city of New York, April 5.

This flue is intended for cylindrical, low pressure boilers, and consists of a flat tube running spirally round from end to end of the boiler, between the exterior case, and an interior cylinder. The claim is to "the application of one or more spiral flues to steam boilers, as described."

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131. For an improved *construction of Canal Boats, for conveying the Horses by which they are towed;* John H. Long, Lewistown, Mifflin county, Pennsylvania, April 5.

"The nature of this invention consists in partitioning off a space about the middle of the boat, on either side, and thus forming a stall, or crib, of suitable length and breadth to receive the horses; and extending from the deck of the cabin to the bottom of the boat, in which is suspended, from the upper deck, a platform by blocks and tackles, for sustaining the horses, and for lowering them to the bottom of the boat when taken on board, and raised to the gunwale when they are to be removed."

"What I claim as my invention consists in the before described construction of the stall, in combination with the suspended platform, in canal boats, for conveying the horses by which they are towed, so as to have one or more of them at rest whilst the others are towing."

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132. For an improvement in *Repeating, or many-chambered, fire-arms;* Henry and Charles Daniels, Chester, Middlesex county, Connecticut, April 5.

In these fire-arms there is to be a countersink, or recess, at the rear end of the gun barrel; and at the outer end of the respective chambers there is to be a projecting rim to pass into this recess. The claims are to "the formation of the projecting rims around the mouth of the chambers, with the

corresponding recess at the back end of the barrel; and also the forming of the evolving axis which passes through the receiver, in such a way as that it shall force the said rim into the corresponding recess, and hold them there firmly, during the discharge of the piece; together with the use and arrangement of spiral, or other springs, within the breech."

We are not yet at the end of the catalogue of the patented many chambered fire-arms, although many of them have already run their short race, and will be remembered only by their *hic jacet* on the shelves of the patent office; and the class of inventors will soon discover that some new object must be started to arrest the attention of the public; a cessation of applications for patents for things of this character must soon take place, and we apprehend that they will not soon be resumed.

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133. For an improvement in the *Mode of Printing certain colours upon calico or other fabrics;* Bennet Woodcroft, Great Britain, April 5.

After describing the mode of procedure adopted by the patentee, he says: "Now whereas I do not claim, as my invention, either the printing machine, or the particular construction or material of the dress to be used by the said operatives. But whereas I do claim as my invention the enclosing calico or other fabric intended to be printed, along with the printing apparatus, whatever it may be, and the material to be printed upon them, in a chamber, case, or compartment, filled with an artificial atmosphere, deprived of, or devoid of, free oxygen, such as atmospheric air, deprived of its oxygen, as hereinbefore described, or any other suitable artificial atmosphere, and there printing the said calico or other fabrics, with a solution of deoxydized indigo when required to produce a blue colour, or with a solution of deoxydized indigo and other suitable materials as are usually used in combination with indigo, when required to produce other colours, and subsequently exposing the said calico and other fabrics, so printed as aforesaid, to the action of the atmospheric air, in order to imbibe the necessary quantity of oxygen therefrom to produce and fix the colours required."

An air-tight room is to be made of sheet iron, and this is to be furnished with an atmosphere of nitrogen; this is accomplished by means of a large air pump, which pumps the water out of the room, passes it through tubes into purifiers filled with a solution of sulphuret of lime, which deprives it of its oxygen, when it passes again into the room through tubes leading from the purifiers; and this operation is continued until no sensible quantity of oxygen remains in it. The entrance into the room is through a tank filled with water, which forms a water lute, by a partition dipping a little way below the surface of the fluid. This serves also to allow fresh air to be forced in by atmospheric pressure, as the volume is decreased by the absorption of the oxygen. The workmen have dresses of India rubber cloth, similar to diving dresses, and air is supplied to them by bellows and tubes, as in diving apparatus.

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134. For an improvement in the *Safety Life Preserver;* John J. White, city of Philadelphia, state of Pennsylvania, April 7.

This life preserver is to pass round the body in the ordinary manner, but instead of being one continued inflated bag, it is formed into a number of separate bags, connected, by mouth pieces and valves, with one common tube, by which they are all to be inflated. One of these bags is made so as

to constitute a bellows, by means of which the whole may be filled. The claims are to "the above method of forming isolated air chambers, rendered independent of each other by the interposition of valves, so that the loss of air in one will not affect the others, and yet capable of inflation from the same source. Also the mode of inflation by the bellows, as a constituent part of the machine, whether applied to life preservers or other manufactured articles requiring inflation."

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135. For an improvement in the *Scythe snath*; Samuel Puffer, Sunderland, Franklin county, Massachusetts, April 7.

The claims are to "a revolving bush, or circular plate, for changing the angle of the scythe, for cutting various kinds of grass, or grain, on various kinds of ground; also the detaching one end of the hook of the nib from the other, to cause it to embrace the snath more firmly," &c.

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136. For a machine for *Shearing Cloth;* Reuben Daniels, Woodstock, Windsor county, Vermont, April 7.

In this machine the shearing is effected by revolving blades, and many of its other appendages resemble those of preceding machines. The particular arrangements upon which the claims are founded are to be understood only by an examination of the whole together; these particular parts are named in the claim, but not in such a manner as would convey any idea of the particular combination in which they operate, and we therefore do not insert it.

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137. For an improvement in *Carriage Springs;* William Sharp, Burdett, Tompkins county, New York, April 7.

There have, of late, been many applications for patents for carriage springs, principally of the elliptic, or bow kind, which have been variously combined together. A number of these applications have been rejected, but a number of them also have been passed, as possessing some degree of novelty in their arrangement, although, in some instances at least, there did not appear to be much of utility connected with it. The claim of the present patentee is to the "bending inwards of the elliptical springs in the manner and for the purpose described, and also the inside stays, or springs, in combination."

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138. For an improvement in *Coach Lamps;* William Lawrence, Wallingford, New Haven county, Connecticut, April 7.

The claim to improvement in this lamp consists in a shank at the bottom of the lamp, into which descends a small tube containing the wick, and in a raised part at the bottom of the lamp. Although these things may be new, they do not appear to be of sufficient importance to require particular description.

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139. For a *Mortising Machine;* Francis and Thomas Burdick, city of Brooklyn, New York, April 7.

The general plan of this mortising machine is that of the larger number of similar instruments; the particular difference is in the manner of working the slides up and down, which carry the chisels. There are two slides, each of which carries a chisel; and these slides are carried up and down alternately by means of a pinion placed between racks on the inner edges of these slides, which are guided between vertical cheeks. A pendulous lever,

or handle, hangs from the shaft of the pinion, and by swinging this backward and forward, the motion of the slides and chisels is obtained. A feed hand is also made to operate in notches on the sliding bed piece which supports the timber to be mortised. The claim is to "the double rack, or slides, to which the chisels are attached, worked by one pinion in the manner described." The granting of the patent is *prima facie* evidence that there is novelty in the thing claimed; we do not perceive, however, in what consists the superiority of this new arrangement of parts, over those of some former mortising machines.

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140. For a *Mortising Machine;* Ira M'Laughlin, Sunderland, Bennington county, Vermont, April 7.

The claim under this patent is to "the method of securing the chisel, by which means it can be readily reversed; and the method of moving the chisel backward and forward." The remark on the foregoing patent may, we think, apply generally to this.

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141. For a machine for *Paring, coring, and dividing apples;* Robert W. Mitchell, Martin's Mill, Richland county, Ohio, April 13.

This, we believe, is the fourth patent obtained for the same purpose; in that before us the apple is to be placed on a fork at the end of a shaft, or mandrel, turned by a crank, whilst the paring knife, furnished with a guard, is held in the right hand, and passed from end to end over the apple; this is then pushed towards the shaft which is furnished with knives that cut it into quarters; a centre, tubular knife removing the core.

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142. For an improvement in *Canal Lock gates;* Franklin Livingston, Waterford, Saratoga county, New York, April 13.

The improvements claimed consist in a particular mode of constructing, or forming, the bearings of the gudgeons of valve, or wicket, gates; and the application of a screw, working horizontally, for opening and shutting such gates; the arrangements of which require, for their illustration, an examination of the drawings.

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143. For an *Apparatus for Extinguishing sparks in locomotive engines;* William T. James, city of New York, April 13.

There are several things in the construction of this apparatus analogous to some others intended for the same purpose. The smoke pipe is surrounded by a second pipe sloping outwards from it, and having a wide, or trumpet, mouth, extending somewhat above that of the smoke pipe; the smoke and sparks from this latter are to escape through lateral, curvilinear openings, by which it is intended to give to the sparks a rotary motion between the two pipes, and allow them to fall, by their gravity, into the receptacle formed by the junction of the said pipes. There is a cover to the smoke pipe in the form of an inverted cone, which is designed to co-operate with the other parts of the apparatus in producing the desired effect; likewise a flanch within the upper edge of the outer tube, sloping downwards, with the same view.

The claim is to "the combination of the outer tube, the flanch, the conical cover, the openings and spiral flues, in their combination with a smoke pipe, or chimney."

We have not heard the result of the experiments with this apparatus.

but are convinced that if it is so constructed as to arrest the sparks, it will, like its predecessors, impede the draught.

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144. For a machine for *Plating dough, and cutting crackers, cakes, &c.*; John M. Neagle, New Haven, Connecticut, April 13.

We are informed that "the principle of this invention is to cause the dough placed in the hopper to pass between two sets of plating rollers, and thence over one or more bed rollers, on which forming and trimming cylinders may operate to give the stamp, or print, and shape intended, and thence discharge it upon baking pans, ready for the oven, by simply turning the crank, or otherwise moving the machinery."

This apparatus is represented in eleven separate figures in the drawing, fully showing the whole arrangement. The claims are to "the friction rollers for the bottom of the hopper, and for the table between the bed rollers, as described. The trimming cylinder. The mode of forcing out the dough, thereby discharging the cutters."

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145. For an *Apparatus for obtaining a high degree of velocity on rail-roads;* Jacob Nollner, city of Washington, April 13.

This is one of those strange conceits which sometimes insinuate themselves into the minds of intelligent men, although it would be difficult for a looker on to find the avenue by which it could obtain an entrance; indeed it might well be supposed that every avenue leading into such minds would be so well guarded by the watchful centinel, good common sense, as effectually to repel such interlopers. The plan proposed is neither practical, or practicable, nor did the inventor himself really think it so, but determined to place it upon record, under an impression that it might suggest, or lead to, something useful; "so mote it be."

Let a rail-road be made, perfectly level and straight, and solid as the everlasting hills; let a car twenty miles long be placed on this, and be drawn by any adequate power; let another car, say of ten miles in length, be placed on this first car, at its rear end, and let this also have an adequate independent motive power applied to it. Now let the two cars set off together at the rate of twenty miles an hour; the upper car will, in this case, travel over the ground at the rate of forty miles an hour, twenty being due to the motion of the lower car, and twenty to its own motion. In the model at the patent office, there are four or five such cars, or movable rail-roads, stratum superstructum. The following is the claim:—

"What I claim is the placing of two or more movable rail-ways, platforms, or articles capable of progressive motion, one above the other, so that each may be drawn along by an independent power applied to it, and, like itself, sustained upon the rail-road, platform, mounted rail-way, or other article upon which it is to move; and this I claim, whatever form or arrangement the same may be made to assume, whilst the principle of action is the same with that herein exemplified."

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146. For an improved *Fire Engine Pump;* Joseph Newman, city of Baltimore, April 14.

This is a device for converting the common street pump into a fire engine, by adding a forcing apparatus at its top, furnished with an air vessel, and other appendages. When thus used, the ordinary spout is to be stopped, and a hose or branch pipe applied to the forcing apparatus. The claim is to

"the combination of the common pump prepared as described, with the cylinder, piston, valves, or air chamber of the ordinary hydraulic or fire engine, which combination produces a twofold instrument, viz. a self supplying fire engine, and a culinary, or common, pump.

There is no novelty in the foregoing idea. The late Mr. Dearborn, of Boston, proposed a similar thing more than forty years ago, of which engravings are to be found in our own, and in foreign, journals. The thing, however, cannot possibly answer a good purpose when appended to the ordinary pump, as the power requisite to raise the water from a well, and to force it to the required height, cannot be applied to such a pump; and, if it could, but few such pumps would bear it. Whatever of ingenuity there may be in such a combination, will not be accompanied by a corresponding degree of utility.

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147. For a *Machine for Mowing, and Cutting, Grass and Grain;* David Lewis, Bern, Albany county, New York, April 14.

In this machine, the cutting is to be effected by a single scythe which crosses the frame from side to side, and has a vibrating motion given to it longitudinally, by means of a crank operated on by gearing from the wheels which run on the ground. The scythe is convex towards its cutting edge, and the grass, or grain, to be cut is borne up against it by the revolution of a cylinder having long projecting fingers, and which is placed sufficiently above, and in advance of, the edge of the knife, to effect the proposed object.

The claims made are to "the particular structure of the traverse bars, and the manner of sustaining and operating the scythe, as described. The revolving comb or straightener preceding the scythe and preparing the grain for its operation, in combination with the scythe, constructed and operating as described. The hind, or caster wheel, in combination as herein described, by which the hinder end of the machine can be raised at pleasure."

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148. For a machine for *Making Bricks;* Samuel B. Brustār, Kensington, Philadelphia county, Pennsylvania, April 14.

In this machine, as in many others, the clay is to be tempered in a circular trough, by means of revolving wheels which roll over it. Outside of the tempering trough there is a moulding trough, within which the moulds are to be laid; and the clay, transferred to this trough, is to be pressed into the moulds by rollers passing over them. The whole machine is a structure of considerable complexity, not well described or represented in the first instance, and not capable of being clearly presented in words. The claims are to a number of particular things referred to in the specification, and, if given, would not convey any definite idea. The machine may be a good one; but as presented, it does not, to us, wear a promising aspect.

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149. For a machine for *Moulding and Pressing Bricks;* Stephen Waterman and Charles Learned, Charleston, South Carolina, April 14.

In this machine the clay is mixed in a vessel, or chamber, in the centre of the machine, in which a shaft revolves, that is furnished with knives, in a manner well known for preparing clay at potteries, and in brick making; by them it is forced into moulding boxes at the sides of the machine, under which the moulds are to be placed on a suitable platform. The claim re-

fers principally to the manner of forcing down the vertical pistons within the moulding boxes; this is done by pieces in the form of inclined planes, and carried round by the sweep attached to the centre shaft; which inclined planes pass against friction rollers at the upper ends of the shafts of the pistons, and force them down; after which they act upon vertical shafts connected with levers that raise the pistons, allowing the filled moulds to be removed, and empty ones substituted for them.

Claim.—"We claim the application of inclined planes to the forcing down the pistons for pressing brick, in the manner described. We do not claim the mixing, or press boxes, or the oblique knives; these and other parts having been previously known and used; all that we claim as our invention being the inclined planes for forcing down the pistons and slides; the particular combination of the two vertical slides, with their connecting parts for lifting the pistons and causing the moulds to traverse on the ways."

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150. For an improved *Water Wheel;* John R. Wheeler, Seneca Falls, Seneca county, New York, April 14.

The water is to be made to strike upon the buckets of this wheel by passing through issues in a circular rim surrounding the wheel. Particular directions are given respecting the curved form of the buckets, but there is not any thing in this wheel to distinguish it from others that have been previously used, excepting these peculiarities of form which do not seem calculated to alter the action in any appreciable degree.

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151. For an improvement in the *Steam Engine;* William L. Lightall, city of Albany, New York, April 14.

The object in view in this engine is so to arrange the levers and other working parts as that the cylinders may be placed horizontally at the bottom of the vessel. This mode of arrangement is described and represented with much clearness and distinctness, and the inventor, after describing it, observes that, "It will appear that the cylinder may, in all cases, be laid horizontally on the keelson, or keelsons, placing it and all the other machinery so low that its weight, instead of its being as it now is, a necessary and unavoidable incumbrance, will act in a great measure as judiciously stowed ballast. That in vessels of war, or armed steamers, all the essential and vital parts of the machinery will be completely protected from an enemy's fire, and that the acting engineer can perform his duty not only with safety, but with that self-possession which personal security could alone insure." The claims refer to the particular description of the respective parts as arranged, but would not, alone, afford any distinct information respecting them.

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152. For an improved mode of *Working the Pistons of Pumps;* David Whittier, Belfast, Waldo county, Maine, April 14.

"The nature of my invention consists in the application of inclined planes inserted upon the outer circumference of a wheel, or cylinder, (which is made to revolve like the capstan of a vessel,) to the spear, or piston rod of a pump, so as to force it up and down."

In the drawing, force pumps are represented as placed near the periphery of a low, vertical cylinder, or drum, on the deck of a vessel, there being levers, or handspikes, to carry the cylinder round. Projecting, inclined ledges come in contact with friction rollers on the piston rods of the pumps,

and alternately raise and depress them. The claim is to this mode of working pumps, and we believe that the patentee might have enjoyed the exclusive right thereto without having had it secured to him by law.

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153. For an improvement in *Many Chambered Cylinder Fire Arms;* Theodore F. Story, Northampton, Hampden county, Massachusetts, April 21.

The general construction of this gun is the same with several which we have heretofore described; there is considerable ingenuity in the arrangement of the respective parts of the lock, and in the device for revolving the cylinder by its action. The percussion caps are to be placed immediately behind the respective chambers in the revolving cylinder. We do not think it necessary to give the claims.

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154. For improvements in the *Machine for making Axes;* Demmon C. Stone, Naponock village, Ulster county, New York; assigned to Joseph Wright, of Poughkeepsie, New York, April 21.

This machine is intended to prepare the axe ready for welding, by taking the piece of iron, cut off of the proper size, and carrying it through all the requisite operations, until ready for the steel. The claim is to the combination of the various parts for that purpose, as described; the necessary complication of these parts is such as to forbid an attempt at description.

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155. For a *Saw Mill without Saw Gates;* John C. Yates, Columbia, Maury county, Tennessee, April 21.

The claim under this patent is equally brief and meagre, and that simply because there was but little to claim, and that little of little importance. It is to "the form of the fulcrum of the vibrating beam, in combination with the rectangular boxes on which it moves." There is a vibrating beam, like that of a steam engine, having a saw affixed, by means of shackle bars, at each of its ends; the lower ends of said saws being, in like manner, connected to cranks on a revolving shaft. The fulcrum of the beam, instead of being a round pin, is polygonal, or triangular, having one of its sides downwards, two of its angles thus becoming fulcra alternately. The supposed advantage of this is set forth in the specification, but we cannot afford the room to give the reasoning on the subject.

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156. For an improvement in the *Steam Engine;* Seth Graham, Roxbury, Norfolk county, Massachusetts, April 21.

This is a bad contrivance, with little novelty, and no utility. A revolving cylinder having a groove around it, such as would be produced by making a section of the cylinder at an angle of forty-five degrees with its axis, and then separating the two parts to a proper distance, to form a groove of suitable width. This groove is to admit a pin on the cross-head, furnished with a friction roller, and is thus to become a substitute for the crank. A shaft is to pass through the cylinder, is to run on proper bearings and to have a fly-wheel at one end; the steam cylinder, and appendages generally, resemble those of ordinary engines. In some places, where substitutes are admitted in the militia, a poor creature is allowed to take the place of an able bodied man; the substitute in this engine appears to us t belong to the same system.

157 For an improved process of *Dyeing Wool;* Felix Fossard, city of Philadelphia, April 21.

Mr. Fossard has obtained patents for the manufacture of the prussiate of iron, and the process of dyeing therewith, which patents have been made the subjects of notice in this journal. Some difficulties, it is understood, presented themselves in the application of the dye to the manufactured cloth, which will, it is believed, be obviated by the proposed process of dyeing in the wool. After giving the necessary instructions for carrying out the process, the patentee says that, "By this process the wool acquires a navy blue at a single dip of five minutes into each of the baths, and this affords a permanent color at a small cost, say five cents per pound of clear wool. The principle of this new process of dyeing does not reside in the salt of potash, or of iron, but with the acid which is added to each of the solutions, the direct action of which consists in its decomposing the fatty matter of the wool, in degrees corresponding with the various tints of blue to be obtained."

"What I claim as new in the above described process for dyeing wool and other similar matters, is the employment, substantially in the manner herein set forth, of an acid solution of the ferra-cyanuret of potassium, or of sodium, in connexion with an acid solution of one of the salts of the black oxide, or of the sesqui-oxide of iron; and also of an acid solution of the sesqui-cyanuret of potassium, or of sodium, in connection with an acid solution of one of the salts of the protoxide of iron; including in this claim the various combinations and modifications of the above named salts of potassium, or of sodium, with those of the salts of iron, an acid being used before, conjointly with, or subsequent to, the employment of the baths containing the respective salts, which yield a blue precipitate by the interchange of their elements."

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158. For an improvement in the *Art of Dyeing;* Patrick Magennis, Paterson, Passaic county, New Jersey, April 21. (See specification.)

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159. For an improved *Drill machine for sowing or planting grain;* George A. Hoyt, city of Albany, New York, April 21.

This machine in many of its parts, resembles others which have been in use, but there is a device for causing the grain to pass out through the dropping tube with increased celerity and certainty. This device consists of four arms of spring steel which project from a revolving shaft in the centre of the seed box. "These are of such length as to come into contact with the bottom of the hopper, and consequently pass over the mouth of the tube through which the seed is to pass; their ends enter this tube with a slight degree of force, but which is sufficient to impel the seed downward at the moment the valve below is opened; whilst at the same time they clear away such superfluous seed as might otherwise fall through." The claim is confined to these spring arms.

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160. For an improvement in the *Working of Bellows by Steam;* Martin Bell, Antis, Huntingdon county, Pennsylvania, April 24.

This contrivance resembles the water bellows, in which an inverted cylindrical vessel is made to rise and fall within a vessel of water, there being a vibrating beam carrying two such blowers. The claim is to the "enclosing

the outer cylinder by a head, through which the piston rod of the cylinder works air tight, by means of a stuffing box; and the particular arrangement and combination of the parts by which the steam is admitted and made to operate on the lower side or interior of the cylinder, as constituting a component part of a blowing machine, in the manner set forth."

We cannot praise this apparatus, and are apprehensive that the inventor will not expect us to do so, if he has carried his plan into operation.

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161. For an improvement in *Rail-road Cars, Carriages, or Trucks, &c.*; Joseph Harrison, Jr., city of Philadelphia, April 24.

The main object of this improvement is to obtain a more equal bearing upon the rails of the wheels of rail-road carriages than has been hitherto attained. The opposite ends of a spring are to bear upon two sliding boxes, in two plummer blocks, which boxes receive the ends of the two axles of the carriage wheels. The spring is of the usual construction, but mounted so as to vibrate on its centre, allowing the two wheels on each side to adapt themselves to the inequalities of the road, without altering the relationship of the action of the spring. Several variations in the mode of arrangement for carrying out the same principle, are described and represented by the patentee.

"In truck frames which turn on a centre, for the purpose of adapting the wheels to the curvature of a road, the patentee has, in order to render the system of the equalization of the pressure of the wheels upon the rails perfect, so constructed the frames of such trucks as that their sides shall not necessarily continue in the same plane, but be allowed to vibrate vertically to such extent as may be requisite to enable them to adapt themselves, and the wheels which they sustain, to any horizontal inequality in the rails upon which they are to run, as this cannot be effected by the limited action of springs."

In this latter arrangement the wooden sides of the truck frame are connected by transverse and diagonal bars of iron, which work on pins, allowing of the requisite vertical motion in the sides, whilst they are braced perfectly so as to prevent their racking laterally. The claims are as follows:

"What I claim as my invention in the within described modes of constructing cars, carriages, or trucks, to run upon rail-roads, is the constructing of the springs and their appendages, so that said springs may vibrate upon their centres, for the purpose, and substantially in the manner, set forth. I also claim the carrying out of the same principle, by means of a vibrating beam, or any analogous contrivance, connected and arranged so as to produce the same effect. I also claim the use of a truck frame which may be employed with cars and locomotive carriages of all kinds, to run upon rail-roads when trucks are required; said truck frame being constructed in such a way as that two parallel sides thereof may be allowed to play, in the manner and for the purpose set forth, whether the same be put together in the method herein made known, or in any other by which the same end is attained, on the same principle."

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162. For improvements in *Many chambered cylinder fire arms*; Rufus Nichols, and Edward Childs, Conway, Franklin county, Massachusetts, April 24.

We shall not dwell upon the specialities of the gun described in this specification; nor shall we give the claim, as this would not afford a knowledge

of the particular arrangements adopted. The general plan is like that of the arms already noticed in the list of patents for this month.

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163. For a *horizontal Straw Cutter*; R. A. B. Beach, Franklin, Williamson county, Tennessee, April 24.

On one end of a frame, or bench, placed horizontally, there is a crank shaft to which is attached a shackle bar, or pitman, which vibrates a slide, carrying knives for cutting the straw, which is placed vertically in a square box, or hopper, over the knives. There are certain appendages for regulating the length of the cut straw, and for other purposes.

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164. For an improved *Gate for flumes of mills;* William Buckminster, Framingham, Middlesex county, Massachusetts, April 25.

This is a simple, sliding gate, moved by a lever, the construction of which is described, though not very clearly, but we have not at the moment either the drawing or the model by us, and therefore pass it over.

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165. For a *domestic Spinner, for spinning wool, &c.;* Hiram F. Wheeler, Springville, Susquehanna county, Pennsylvania, April 25.

This is a device for enabling the spinster to spin a single thread without running out from the wheel, in the old fashioned mode, but allowing her to keep her seat during the whole process. The head carrying the spindle is made to run out upon ways, and to return back, by a complex kind of machinery, which we do not think it worth while to describe, and which there is little probability that our readers will ever see, unless it be in the form of a model, at the patent office. The only thing claimed is "the sliding of the head on ways in the manner described."

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166. For a machine for *pressing Bricks*; Gaylord V. Harper, Batavia, Genessee county, New York, April 25.

A horse is to turn a vertical shaft, by means of a lever, or sweep, and this, in its revolution, is to operate four, or more, pistons which press upon the clay, previously tempered, and placed in the moulds for that purpose. The description and drawing do not clearly exhibit the structure, and the claim is merely to "the mode of pressing and discharging bricks, as described."

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167. For an improved mode of *applying the Syphon for the uniform drawing of oil and other liquids*; James Gray, Fredericksburg, Spottsylvania county, Virginia, April 25.

The syphon is to float on the liquor to be drawn, so that its height and the level of the liquid may always correspond; for some of the purposes to which it is proposed to apply it, it may be valuable; we doubt its eligibility for lamps, however, although for lubricating some machinery it may answer well. The patentee says: "I am aware that the syphon is a common thing; but what I claim as new, and as my invention, is the using it in combination with, and attached to, a float, to support it on the surface of the liquid, for the purpose of drawing liquids out of the vessel which contains it, in uniform and equal quantities, as described, or in any way which is substantially the same.

"2d. I claim as new, and as my invention, the application of the syphon for the purpose of dripping oil, or any other liquid, on the mandrils and bearings of machinery, or for the construction of lamps, as set forth in the

specification and drawings; and in any way which is substantially the same in principle.

"3d. I claim as new, and as my invention, the small tube to slip up and down in the inside, or on the outside, of the leg of the syphon, whether to work with a screw or otherwise, so as to lengthen or shorten at pleasure, and for the purpose of increasing or decreasing the quantity it discharges in a given time."

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168. For improvements in the *Many-chambered cylinder Fire Arms*; Mighill Nutting, Portland, Maine, April 25.

We have already noticed three patent many chambered fire arms in the list for the present month. That now before us is like the others, having a revolving cylinder of chambers, and differing from them only in the arrangement of the lock, the apparatus for revolving the barrel, and their appendages.

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169. For a *Horse Power for propelling machinery*; James Secor, city of New York, April 28.

The platform upon which the horse is to walk is an endless floor passing round cylinders, and differing but little from many others; the main difference between this and similar horse powers consists in the addition of a governor, such as is used in steam engines, for raising or lowering one end of the platform, and thus regulating the rate of its motion; this application is claimed.

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170. For an improvement in *Water wheels*; John Mumma, West Alexandria, Preble county, Ohio, April 28.

The variation in this wheel from some others is not of a character to render particular description necessary; the claim is to "the combination of one, two, or more, tub wheels, with the wheel placed next the schute, and the mode of regulating the outlet of water, as described."

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171. For a machine for *Mortising and tenoning Timber*; Henry Barnes, Munson, Geauga county, Ohio, April 28.

The subjoined claims, although they do not lead to a knowledge of the particular structure of the parts, serve to show that the improvements are in mere matters of arrangement, leaving the rest of the structure the same with that of other mortising machines.

"I claim the construction of the carriages with the rests, bar clamps, and clamp bolts, as described. The arrangement of the lever and wedge for throwing the pinion out of gear, with the racks, as described. The method of connecting the pulley with the piston shaft by the spring, for allowing the pully to turn on the shaft as the cutting tool enters the wood."

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172. For an improvement in the *Saw Mill*; James Secor, city of N. York, April 28.

The claims are to a mode of feeding the carriage, and to a connecting lever for giving motion to the saw gate. The arrangements in this mill are such as to render it portable, and to adapt it to its being driven by horse, or other power, applicable to such mills. The saw frame is to be worked up and down by means of a lever beam, operated by a crank on the fly wheel, and there is, as the claim indicates, some novelty in the mode of feeding.

16*

173. For improvements in the *Machinery for making brooms, brushes, mops, &c.*; John M. Spooner, Belchertown, Hampshire county, Massachusetts, April 28.

The patentee says that the nature of his invention consists in "providing a method of holding the broom, and furnishing and regulating the wire, or twine, by machinery, in such a manner as to permit the manufacturer to sit upright during the operation, and thereby to obviate the stooping position so injurious to health, which has been heretofore practised." The machinery consists, in part, of an apparatus revolving like a lathe, and carrying a spool for supplying the wire, or twine. The particular devices used form the main subject of the claim, and these are represented in the drawing.

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174. For a *Churn*; Joshua G. Pike, Lisbon, St. Lawrence county, New York, April 28.

This churn consists of a horizontal trough which is a section of a cylinder, having a shaft revolving in the centre of its curvature; from this shaft project paddles, or flights, standing at any convenient angle with the shaft, and in reversed direction from the centre towards each end. When the shaft is turned in one direction, the contents are gathered from each end towards the centre, and *vice versa.*

The claim is to "the placing of the paddles around the shaft, so that they shall direct the cream and butter towards the centre, or from the centre towards the ends, in the manner and for the purpose set forth."

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175. For an improved mode of *forming Kilns for making Charcoal,* Michael Carroll, Tellico Plains, Monroe county, Tennessee, April 28.

The specification of this patent directs the mode of piling the wood, when it consists of very large logs, in such a way as to burn them properly into charcoal in a kiln, managed, in other respects, in the ordinary way, and the claim is confined to the particular mode of piling pointed out.

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176. For a *Hinge for doors,* denominated the helical spring joint hinge; D. A. Hoyt, and P. W. Bulkley, Danbury, Fairfield county, Connecticut, April 28.

This hinge is to operate as a door spring, and for this purpose it is so constructed that instead of the middle knuckles of the hinge, a helical spring surrounds the joint pin, the two ends being so attached as to cause the hinge to close by the elastic force of the spring. Two portions of the hinge may, if desired, be so provided with helical springs; these may be made of brass wire, and they have a very neat appearance. The claim is to "the coiling of a spring around the joint pin of door, or other, hinges, in the manner set forth, such tension being given to said springs as shall cause them to close a door or other hinged article to which they may be applied; said hinge being constructed substantially in the manner set forth."

Specifications of American Patents.

Specification of a Patent for an improvement in the Manufacture of Gunpowder; granted to Richard J. L. Witty, *Lowell, Massachusetts, April* 2, 1838.

To all whom it may concern: Be it known that I, Richard J. L. Witty,

civil engineer, of the city of Lowell, state of Massachusetts, have discovered a new and powerful composition for the manufacture of gunpowder, and I do hereby declare that the following is a full and exact description thereof.

My discovery consists in using a material capable of yielding a large quantity of carburetted hydrogen, or inflammable gas, namely, bituminous coal. The coal is to be highly comminuted with certain proportions of sulphur and nitrate of potash. These three substances are taken in a powdered state, and then mixed together; but, since these ingredients vary in quality, or otherwise, they will require their definite proportions to be adapted to each other. Here follows a formula which I have used, and found to answer well, viz.:

Bituminous coal, ...	26 lbs. or parts.
Nitrate of potash, ...	156
Sulphur, ...	33½

And in order to make the gunpowder, the above ingredients are to be intimately mixed together, as must be the case in preparing gunpowder from any materials, and then the combination may undergo the same process as is at present practised with common gunpowder, viz. in the pressing, graining, glazing, and drying.

What I claim as my discovery is the making use of bituminous coal, instead of charcoal to form gunpowder with the other ingredients at present used, viz. sulphur and nitre, and for the use of these two last named ingredients I do not claim any exclusive right.

Richard J. L. Witty.

Remarks by the Editor.—We very much doubt the improvement of gunpowder by the substitution of bituminous coal, for charcoal, in its composition; the production of carburetted hydrogen, spoken of by the patentee, will rather be a production of carbonic acid and watery vapour, these being the ultimate products of the combustion of the bitumen. We are very apprehensive, however, that the decomposition of the bitumen, and the combination of its constituents with oxygen, will not be equally rapid with the combination of charcoal and oxygen; this it is true, must be decided by experiment, and should the fact be such as we apprehend, the explosion will take place without the perfect decomposition of the bitumen, the powder will be injured in quality, and it will render the piece more foul than powder of the ordinary composition, which, indeed, when well made, does not require to be improved, as, if more powerful, the arms in which it must be used must necessarily be increased in weight.

Specification of a Patent for an improved method of forming Plates or Cylinders, with raised surfaces, for printing and stamping impressions on paper, silk, calico, cotton, and other fabrics or substances. Granted to Godfrey Woone, *of the Kingdom of Great Britain, April* 2, 1838.

My invention consists in improvements in forming moulds or matrices, from which casts are to be taken in metal, or other substances capable of receiving a sharp impression, having on their surface the relief of the pattern, engraving, writing, or design, intended to be printed, or impressed, on calico, silk, paper, leather, or other fabrics, or substances on which impressions are now commonly taken from plates, blocks, or cylinders, with raised figures, engravings, or designs, produced thereon by cutting, engraving,

stamping, etching, or otherwise lowering the parts, or interstices between the work intended to be left in relief, or from stereotype casts obtained from such original plates or blocks. I obtain my moulds by the following methods, according to the nature of the pattern, engraving, or design, I am desirous of obtaining in relief. For the finer patterns used in calico, or other printing or paper staining, or for engravings such as are usually cut on box wood, and printed at a type-press, I make use of the following method: I take white lead and plaster of Paris, in different proportions, about two parts of white lead and one of plaster of Paris, mixed with water to the consistence of cream; I then pour this mixture, or composition, on a well polished and perfectly even plate or block of metal, or other hard substance, of the required size, varying the depth of the composition to the height of the required relief. For work to be printed at the type-press in the manner of wood engravings, the thickness of the layer, or composition, need not exceed the twenty-fourth part of an inch, but for coarser patterns, or designs, as for calico printing, the thickness of the composition must be increased to about the eighth part of an inch. The plate, or block, covered with the above composition, must be left to dry gradually, or be baked until it is entirely dry. Or in order to give this coating a more even and perfect surface, and obtain with greater exactness, the required thickness, or height, I lay the composition, or coating, on the plate, or block, thicker than I intended to work upon. After the coating has been well dried, I scrape or smooth the surface down to the required thickness with a piece of metal having a perfectly true and even edge or surface. I first trace on this composition, or coating, the design or pattern, in the usual manner now employed by engravers, or artists. I then proceed to engrave, etch, scratch, or draw, with a steel point, or other suitable instrument, or machine, all the lines or parts of the design through the composition or coating down to the metal, or substance, on which the composition or coating is laid. I now describe the second manner of forming my moulds, or matrices, which is preferable for the coarser patterns or coloring blocks used in calico or other printing, but may also be applied to finer work. I take a piece of metal, wood, paste-board, stone, or composition of plaster of Paris, of the height of the intended relief, and I glue, or otherwise fix, the same on a block of wood, metal, or other suitable material. I then cut, engrave, or etch, with acid in the usual manner employed by engravers, either the outline or the whole of the pattern, or design; when the outline only has been cut, engraved, or etched, it is necessary that those parts that are within the outline of the pattern, or design, should be taken out, or removed, in order to form a perfect mould, or matrice, of the pattern, or design, to be obtained in relief. If acid is used for obtaining this mould in metal, stone, &c., the plate of metal, or stone, &c., may be fixed on a block of wood, paste-board, or any other substance that is not liable to be corroded by the acid used for biting in the mould of design, or pattern.

It is necessary in order to procure a perfectly clear impression from the casts to be obtained from these moulds, that some parts should be lowered or depressed, in order that those parts may not receive the printing ink, or matter, when applied to the relief, and so produce a blurred, or imperfect, impression on the paper, calico, or other substance to be printed on. In order to effect this, I either take a cast from the mould immediately after it is finished, by the methods I have before described, and then proceed to finish the cast ready for receiving the ink, color, &c., by the usual methods employed by wood engravers, of cutting, engraving, scooping, or lowering

those parts of the cast which, in consequence of the distance between parts of the design, &c., require to be deeper than the rest, or I make use of the following method. After the whole of the design, engraving, or pattern, has been engraved, cut, or etched, on the composition of white lead and plaster of Paris, wood, metal, or other substance directed to be used for that purpose, I lay, or fix, on those parts of the mould required to be heightened for the purpose of obtaining a corresponding depression on the cast, or impression to be taken from it, with any convenient or suitable instrument, modelers' clay, or other fine earth, or composition, to the height required, taking care not to injure, or interfere with, the design or pattern which has been drawn, cut, or executed, on the mould or composition. Or the heightening matter may be laid on in the following manner: mix chalk, white lead, or any similar substance, with water, as thick as can be conveniently laid on with a brush, and apply this composition, or mixture, to those parts of the mould which require to be raised. When this last mentioned mixture is to be applied to the layer or composition of white lead and plaster of Paris, the mould or design drawn on the plate and layer of composition must be first carefully and slightly oiled.

In order to prepare the moulds for the operation of casting, they must always be perfectly dried, which may be effected either by allowing them to dry gradually, or baking them. These moulds may be cast, stamped, or moulded, in metal, papier-maché, or other substances now in use for obtaining casts of fine work for ornamental or other purposes capable of being cast, stamped, or moulded, and receiving a sharp and clear impression from the mould, and at the same time sufficiently hard for the purposes of printing. As there is no new feature in the method of obtaining a cast from my moulds, I do not consider it necessary to describe the process of casting, stamping, or moulding, as they may be cast by any of the usual methods employed for fine casting, and known to practical men, acquainted with the subject; but for casting fine work, similar to wood engravings, I prefer the method made use of in the process of stereotyping, or casting from moulds taken in plaster of Paris from original wood engravings. I likewise make use of the same metal or composition used for that purpose.

Casts may also be formed by placing the mould in any convenient box, or form, and pouring suitable metal into the mould or design.

The back of the plate is to be turned even in a lathe and mounted on wood, in the manner of stereotype casts from wood engravings, or letter press.

When the plates, or relief, are to be applied to cylinders, the metal, or substance, on which the mould is formed should have a circular, or curved form, corresponding with the circumference of the cylinder on which the plate of metal, or relief, is to be fixed; or the plate may be cast level and the required circular direction given by pressure.

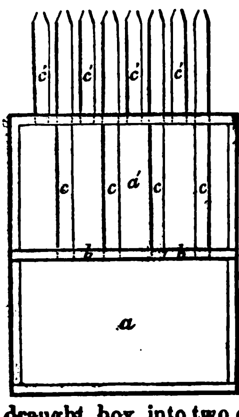
It may be observed that I do not claim as new, or as part of my invention, the mode of cutting, engraving, scratching, or etching, with acid for the purpose of forming a sunk design, or pattern, as they have long been known and practised for obtaining impressions on paper, &c., in the manner of copper plate engraving; but I claim as new the application of these methods in the manner I have described for the purpose of forming moulds from which casts can be obtained in metal, or other substances, having on their face the relief of the design, or pattern, which has been so cut, or etched, in intaglio, and by which means I effect a great saving of time and labor, in producing a relief compared with the method, or methods, now in

use, of first drawing the design, or pattern, on wood, and then cutting, engraving, scooping, or removing, all the parts, or interstices, between the lines, or tracings, of the drawing, which is attended with difficulty and inconvenience, and requires greater labor, time and skill than are required to form a relief by the methods herein specified. GODFREY WOONE.

Specification of a patent for an improved Draft Box for Locomotive Steam Engines. Granted to ANDREW M. EASTWICK, *city of Philadelphia, April* 5, 1838.

To all whom it may concern: Be it known, that I, Andrew M. Eastwick, of the city of Philadelphia, in the state of Pennsylvania, machinist, have invented a new and improved mode of constructing a draught box, to be applied to the chimneys of locomotive, or other, engines, for the purpose of increasing the draught by the action of the waste steam, and I do hereby declare that the following is a full and exact description thereof.

It has been the practice heretofore, where draught boxes have been employed for the purpose of increasing the intensity of the fire, by accelerating the rapidity of the current up the chimney, to suffer the waste steam from each of the cylinders of the engine to escape from them into one common compartment, or single draught box, whence it passed through suitable tubes into the chimney; in this mode of procedure, however, it has been found that there is an interference of the force of the escape steam from one cylinder with that of the other, so that the greatest useful effect is not produced. To obviate this difficulty, I divide my improved draught box into two compartments by means of a partition, or diaphragm, so formed and arranged as to cut off all interfering communication between the two, and to obtain the full effect of the waste steam.



In the accompanying drawing, which represents a vertical section through the centre of the draught box, *a*, and *a'*, are the two compartments into which is divided by means of the partition, *b*, *b*; the waste steam from one of the cylinders enters the compartment *a*, and from the other cylinder the compartment *a'*, through proper openings, constructed for that purpose, in the usual way. From the compartment *a*, the tubes *c*, *c*, *c*, lead through the compartment *a'*, and into the chimney, whilst from the compartment *a'*, the tubes *c'*, *c'*, *c'*, likewise conduct the steam into the chimney; at the escape end, these tubes, *c*, *c*, *c*, are usually narrowed to increase the intensity of the blast.

All that I claim as my invention, and wish to secure by letters patent, is the division of the draught box into two distinct compartments, in the manner and for the purpose set forth; not intending to confine myself to any particular form of apparatus, but to vary this as I may think proper, whilst the same effect is produced by means substantially the same.

ANDREW M. EASTWICK.

Specification of a patent for an improvement in the art of Dyeing. Granted to PATRICK MAGENNES, *Paterson, Passaic county, New Jersey, April* 21, 1838.

To all whom it may concern: Be it known, that I, Patrick Magennis, of Paterson, in the county of Passaic, and state of New Jersey, have discovered a new and useful improvement in the art of dyeing, and I do hereby declare that the following is a full and exact description of said improvement.

The nature of my improvement consists in performing the operation of dyeing by one process, which is effected in the following manner.

The cloth, or other material to be dyed, is taken, without any previous preparation, and passed through the vessel, or box, containing the colouring matter, and from thence, immediately passed between heavy rollers, or squeezers, whereby the colouring matter is effectually forced into the cloth, or other material.

It is then dried; and being so dried it is passed through the vessel, or bag, containing the proper mordant, and from thence again immediately passed between heavy rollers, or squeezers, whereby the mordant is also effectually forced into the cloth, or other material, which is then dried, and the process of dyeing is finished.

The colouring matter and mordants to be used in this process are the same as those commonly used by dyers, except that in this process they are more highly concentrated, and the degree of concentration depends upon the shade of the colour required. The rollers, or squeezers, and colour boxes commonly used by dyers, may be used for this process. But what I claim as my discovery and invention, and desire to secure by letters patent, is the manner of applying the colouring matter and mordants in a concentrated state, to the dry cloth, or other material to be dyed, by passing the same between rollers. PATRICK MAGENNES.

Progress of Practical and Theoretical Mechanics and Chemistry.

Mr. H. Pattinson "On a new process for the Extraction of Silver from Lead."

The object of this paper was to lay before the Section an account of a discovery made by the author some time ago, the application of which to practice constitutes a new process in the arts, and forms an important improvement in the operation of extracting silver from lead. When the quantity of lead raised annually in England and Wales is taken into account, the importance of any improvement in the process of obtaining it with greater facility, will at once be duly appreciated. In 1828, the quantity raised was 45,500 tons, from the following sources:

	Tons.
Mines of Alston Moor, Weardale, Derwent, &c.	22,000
Swalefield, Grassington-Palety, &c., Yorkshire	4,700
Derbyshire,	3,000
Shropshire,	1,800
Devonshire and Cornwall,	2,000
Wales, principally from Flintshire and Denbighshire,	12,000
	45,500

The quantity has varied very little since the above date. The whole of this lead contains silver. Of the 22,000 tons of lead raised in the mines of Alston Moor, Weardale, Teesdale, &c., about 16,000 tons contain silver at the rate of from 6 to 12 oz. per ton, the average being about 5. The 4700 tons from Swaledale &c. contain, as nearly as possible, 2 oz. per ton. The Derbyshire and Shropshire lead contains about an ounce, or the latter about 1½ oz. per ton. The lead from Devon and Cornwall contains from 20 to 30 oz. per ton. One half of the lead from Flintshire and Denbighshire averages from 4½ oz. to 6½ oz. per ton, and the other half 9 to 10 oz. The old process for separating this silver was by cupellation, or refining. This process depended on the well known circumstance, that lead, at a red heat, is easily and readily converted into an oxide; while silver, almost at any temperature, retains its metallic state. It consists, therefore, in exposing lead to a full red heat, with free access of air, so that the whole of the lead may be converted into an oxide, and separated from the silver, which is left behind in a state of purity. This oxide being mixed with coal, and heated to full redness, in a proper furnace, is reduced to the metallic state, called, in commerce, refined lead. But it is impossible to carry on the process of refining without a considerable loss of lead, as the oxide is very volatile, and flies off in large quantities from the refining furnace, in the form of a dense yellow smoke. The quantity of lead refined in 1828 would appear to be from

Alston Moor, Weardale, &c., . .	12,000
Devonshire and Cornwall, ...	2,000
North Wales, ...	4,000
	18,000

Upon which there would be lost, in refining, at least 1000 tons of lead. The importance of some more economical process was, therefore, at once apparent. The first idea which occurred to the author was, to distil the lead and leave the silver behind. A quantity of lead was accordingly introduced into a stoneware retort, and heated to redness for several hours. The retort was found to be in quite a soft state, from the intensity of the heat, and only a small portion of the lead had risen in the form of vapour, and been condensed on the upper part of its neck. But the fact was settled, that lead may be distilled, without determining whether it carried silver along with it. The next idea was, that as the specific gravity of silver is less than that of lead, there might possibly be a tendency in the silver to rise up to the top of a mass of lead, kept melted a long time at a uniform temperature; but, in no instance was there the least trace of any separation. Various other experiments were tried without success; but, in January, 1829, the author happened to require lead in a state of powder, and, to obtain it, adopted the mode of stirring a portion of melted lead in a crucible, until it cooled below its point of fusion, by which the metal is obtained in a state of minute subdivision. In doing this, he was struck with the circumstance, that, as the lead cooled down to nearly its fusing point, little particles of solid lead made their appearance, like small crystals, among the liquid lead, gradually increasing in quantity as the temperature fell. After observing this phenomenon once or twice, he began to conceive, that possibly some difference might be found in the proportions of silver held by the part that crystallized, and the part that remained liquid. Accordingly, he divided a small quantity of lead into two portions, by melting it in a crucible,

and allowing it to cool very slowly, with constant stirring, until a considerable quantity crystallized, as already mentioned, from which the remainder, while still fluid, was poured off. An equal weight of each was then submitted to cupellation, when the button of silver from the liquid proved to be very much larger than that from the crystallized lead; and thus the somewhat curious fact was discovered, that fluid lead, holding silver in solution, suffers a portion to escape from it, under certain circumstances, in the act of becoming solid. The lead used in the original experiment was what is considered rich in silver. It contained 4 oz. 15 dwts. 8 grs. per ton, and was divided into a crystallized portion, found to contain 25 oz. 4 dwts. 21 grs.; and a fluid portion holding 79 oz. 11 dwts. 12 grs. per ton, the latter being necessarily much smaller than the former in quantity. It was not until the spring of the year 1833, that the author was conveniently circumstanced to proceed in applying to practice the principle which he had developed. Four or five tons of lead being melted in a large cast iron pot, was carefully freed, by skimming, from all dirt and oxide, and its surface made quite clean. It was then suffered to cool very slowly, care being taken to break off and mix with the fluid mass, from time to time, any portion that might congeal on the sides of the pot. When the temperature had fallen sufficiently, small solid particles or crystals began to form, principally upon the surface of the melted mass. These, if suffered to remain, would have adhered together and formed a solid crust; but being continually struck, and the whole body of metal kept in motion by constant stirring, they sank down to the bottom of the pan, and soon appeared in considerable quantity. The author, however, did not succeed in making the lead sufficiently poor in silver; a pot filled, for example, with 8 oz. of lead, would yield at first crystals holding from 1 to 2 oz. of silver; in a little time, as the lead in the pot became richer, by receiving silver from the previously formed crystals, it yielded crystals of 2 to 3 oz. and the crystals became progressively richer, until in the end the original lead was divided into three parts of crystallizing lead holding about 4 oz., and one part liquid lead holding about 20 oz. per ton. In order to drain the crystals more completely from the liquid lead, they were exposed, after withdrawal from the pot, to a reverberating flame, so as to melt out more liquid lead. In this way, from lead holding 12 oz. of silver per ton, there were obtained four parts of lead containing ¾ oz. per ton, and one part containing 50 oz. per ton. The exposure, however, a second time to heat was expensive, and the author was induced, in consequence, to recommend, in preference, the simple plan of repeated crystallization; it has now become the established process. The apparatus required for the separating process is exceedingly simple, and consists merely of a number of nearly hemispherical iron pots, each capable of holding about five tons of lead—the size for which is about four feet diameter, and two feet three inches deep; one or two smaller pots, eighteen inches diameter by two feet deep; one required for the purpose of holding melted lead, in which the perforated iron ladles are to be occasionally dipped, to keep them hot; and another pot about two feet ten inches diameter, by one foot ten inches deep, for melting the ultimate poor lead to be cast into pieces. These, with a few perforated iron ladles, fifteen inches diameter, and five inches deep, and one or two whole ladles of lesser size, for casting the melted lead into pigs, are the principal articles required. The large pots are to be placed side by side in a line, each with a separate fire-place, (upon which there must be an ashpit door as well as a fire door,) and also with a separate flue and damper, and the heat of the fire in some measure retained by shut-

ting the ashpit door. Above the centre of this line of pots, at the height of six or eight feet, it is convenient to have a small iron railway with a frame or carriage, on four wheels, to move backwards and forwards the whole length of the range of pots, from which is to depend a chain terminated by a hook at the bottom, and reaching to nearly the top of the pots. This is for the purpose of more easily conveying the ladles filled with crystals from pot to pot. All this being provided, one of the large pots is filled with lead containing silver, say 10 oz. per ton, and after it is melted and skimmed, the fire is withdrawn, the damper put down, and the ashpit door closed, when it cools and crystallizes as already described. Crystals, as they are formed, are ladled out into the second pot, until about three-quarters of the whole have been removed, which will contain about 5 oz. of silver per ton: upon this the operation is repeated, giving lead of 2 oz.; and by a third crystallization, there is obtained, from this poor lead, holding not more than from 10 to 15 dwts. per ton, which is cast into pieces for sale as separated lead. The rich lead, on the other hand, is collected and repeatedly crystallized until it is made to contain 200 or 300 oz. per ton, after which the silver is extracted by cupellation. In working, the different pots at each stage are filled up always with lead of the same content of silver before beginning to crystallize, and a greater or less amount of crystals taken out, as the operator may think fit; in which respect the practice differs almost at every establishment, but the process is so very simple, and the mode of proceeding so obvious, that it is unnecessary to give a more minute detail. By operating in the way described, it is evident that but a very small portion of lead is made to undergo the process of cupellation, not more than one-twentieth part, when 10 ounce lead is enriched to 200 ounce by repeated crystallization; and as the loss by separation has not been found to exceed a 250th part of the whole lead, the loss by the joint processes becomes —$\frac{1}{12}$ of $\frac{1}{20}+\frac{1}{250}$, or about one part in 120. The expense of separation is somewhat less than that of cupellation, so that by the reduction of expense and the reduction of the loss of lead, the extraction of silver is so far economized that 3 oz. per ton will now fully cover the charge. Applying this to the whole lead raised in the kingdom, as determined in 1828, we find that a much larger proportion can now be made to yield up its silver with advantage; we have, for example, within the limits,

	Tons.
All the lead of Alston Moor, Weardale, Teesdale, Derwent, &c.	22,000
Devonshire, Cornwall, and West Cumberland	2,000
Lead of North Wales	12,000

making a total of 36,000 tons, from which, if we deduct the quantity formerly refined, we have an increase of 18,000 tons; and allowing this to contain, which it will do on the lowest average, 6 oz. of silver per ton, and 3 oz. to cover the cost of extraction, we have a clear gain to the arts of 54,000 oz. of silver per annum. The annual saving of lead will be about 300 tons. It is an important fact connected with the separating process, that the separated lead is much improved in quality, being more soft and ductile than ordinary lead. The reason of this is, that when the crystals are withdrawn from the liquid lead, being in the state of a coarse and very clean metallic powder, they are most readily acted on by the oxygen of the atmosphere, and come in contact with a great extent of heated surface, and the more oxidizable metals contained in the lead, as iron, zinc, &c. are separated. It is not improbable that the crystals are somewhat in the condition of spongy platinum, or Faraday's clean metallic plates. It now only remains to consider the reason why

the lead, in the act of consolidation, does so to the exclusion of the silver; and the most simple explanation seems to be, that the process is an instance of true crystallization, the homogeneous particles of the lead coming together by their molecular attraction, and repelling the heterogeneous particles of the silver. It is true, that, on account of the constant agitation, no trace of regular form can be seen in the solid mass, but if one of the pots in the act of consolidation, be allowed to remain a few moments at rest, so that a skin forms on the surface, it will be found, on removing carefully a portion of this skin, that it is distinctly crystalline on its under surface; which proves that it is only the agitation which prevents its always exhibiting this structure. It is well known, that when sea water freezes, the ice is nearly fresh, the salt remaining dissolved in the surrounding water; and that salt water requires a lower temperature for freezing than pure water. To this fact the phenomena of the consolidation of lead containing silver appear to be analogous, the fusibility of the lead being somewhat increased by the alloy. It may seem anomalous that lead, when alloyed with a metal, the melting point of which is so high, should be more easily fusible than the pure metal; but we have among metals many analogous circumstances. That such is the case, is further proved by the fact, that when lead containing silver is gradually fused, the first melted portions are richer in silver than the rest. The difference of fusibility is, however, not sufficient to allow of the separation of silver from lead by the ordinary process of eliquation; for in experiments made with the view of ascertaining how far this method might be employed in practice, in which the lead was exposed, on the grating of the reverberatory furnace, to a heat very cautiously increased till some drops of metal came out, it was found that, in lead containing 5 oz. 8 grs. of silver per ton, the first few drops sweated out contained 7 oz. 17 dwts. 9 grs. of silver; and that when two-thirds were drained off, the portion left contained still 3 oz. 13 dwts. 16 grs. of silver per ton. In another experiment, a piece of the same lead, drained very slowly, till reduced to one-fourth or one-fifth of the original quantity, left lead containing per ton 1 oz. 17 dwts. 15 grs. of silver. Brit. Assoc.—Atheneum.

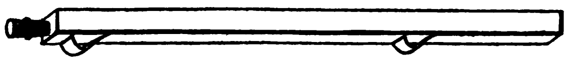
Instrument for Drying Silk in the Loom. *By* James Ryan.

Silk thread, like all other vegetable or animal substances composed of fine fibres, is hygrometric; that is, when exposed to a damp air, it absorbs moisture, from which it cannot afterwards be freed, except by raising the temperature sufficiently to convert the water into vapour, or to dissolve the water by the action of very dry air. Silk, in contact with damp air on all sides, becomes more moist, and in a shorter time, than similar silk wound into a ball or on a roller. A silk warp while in the loom, and partly woven, is wound on two rollers, the one, that on which the whole warp is first wound, and from which it is unwound and transferred to the second, or cloth roll, in proportion as it has passed through the process of weaving, and is become cloth. The space between these two rollers may be divided into two portions, separated by that part across which the shuttle passes; the portion between this part and the cloth roll being already woven into cloth, and the other being that part of the warp which has been wound off the roll, and is coming up through the harness to the shuttle. This portion is called the porré, and consists of parallel threads exposed, both above and below, to the air. In damp, cold weather, and during the winter generally, when

the weaver leaves off work at night, the air of his workshop becomes colder and damper, till its state nearly approaches to that of the outer air; and, therefore, when the weaver is desirous of beginning his work again in the morning, he finds the porré has become damp; the adjacent threads have, therefore, a tendency to rub hard against one another in making the shed, and the work proceeds heavily and slowly till the fire of his shop has become powerful enough to evaporate the moisture, which often will not be effectually done in less than two hours. Besides the loss of time hence arising, the work done under such circumstances feels loose and spongy, and is very liable to cockle, from certain parts of the threads being more moist than the others during the weaving, especially when two or more kinds of silk are employed in the same warp.

Another disadvantage is, that the brighter dyes now used, especially for spring wear, are many of them so fugitive, that they are much injured by mere dampness, to which they are particularly liable, as they must, of necessity, be woven during the winter. These difficulties and imperfections affect both the weaver and his master in so serious a degree, as to render their removal a matter of no small importance.

Mr. Ryan, after several unsuccessful attempts, at length hit on the simple instrument about to be described, with which he has always obtained the most satisfactory results.



It is a hollow quadrangular prism of tin plate, with a round neck at one end, closed by a cork; the length of the prism is about equal to the length of the porré, and on the under side are two handles to render it more manageable. The prism, being filled with hot water, is applied first to the under, and then to the upper surface of the porré, till, by means of it, all the moisture is evaporated. This is often so considerable as to cause a visible steam while it is passing off. The instrument is then applied to the harness; and the whole is thus made dry, and brought into a state proper for working in from ten to twenty minutes, according to its previous state of dampness.

From the evidence of practical weavers, who have made use of Mr. Ryan's instrument, it appears that the injury caused by dampness, both as regards the work and the more fugitive colours, is not at all exaggerated, and that, by the use of the instrument, they have constantly obtained the advantages attributed to it by the inventor. Ibid.

Centripetal Dial Plate. *By* C. and J. M'Dowal.

The word *centripetal*, applied by Messrs. M'Dowal to their dial plate, is liable to mislead; it having no reference, as used by them, to centripetal force, but merely implying that the divisions indicating minutes, instead of being placed on the circumference of the plate, (as is the common practice) are arranged in concentric circles, and are reckoned from the outer towards the inner circle.

In the common dial plate, while each of the hour spaces occupies one-

twelfth of the circle, the sum of the minute spaces for each hour occupies the entire circle. By this contrivance, a space sufficiently large for the clear indication of each minute, is rendered consistent with a dial plate of moderate size. But, in this case, it is evident that two hands, or pointers, are required, of which that which indicates minutes must move twelve times as fast as that which indicates the hours. If each hour space, instead of being divided into five, were divided into sixty, it is obvious that then the hour hand itself would indicate the minutes; and, therefore, that the minute hand, with the mechanism by means of which it is connected with the hour hand, would be saved.

Both Dr. Franklin and Dr. Ferguson invented clocks on this principle; that is, with only one pointer, and arranged their dial plates accordingly. The dial plate of the present inventors is far more simple than those invented by either of the two philosophers above mentioned. But, in order to overcome the difficulty of dividing each hour space with sufficient minuteness, a large plate is necessary. Each hour space is divided into three equal parts, by radial lines, and these parts are each subdivided into ten, the marks indicating the subdivision being placed (for greater distinctness) not side by side, but corresponding with ten concentric circles, and are read off, beginning from the outer, and going in succession to the inner, circle. Thus each hour space is divided into thirty parts, each of which indicates two minutes. Ibid.

Various Methods of Bronzing Casts, &c.

Bronzing is the art of giving to objects of wood, plaster, &c. such a surface as makes them appear as if made of bronze. The term is sometimes extended to signify the production of a metallic appearance of any kind upon such objects. They ought first to be smeared over smoothly with a coat of size or oil varnish, and when nearly dry, the metallic powder made from Dutch foil, gold leaf, mosaic gold, or precipitated copper, is to be applied with a dusting bag, and then rubbed over the surface with a linen pad; or the metallic powders may be mixed with the drying oil beforehand, and then applied with a brush. Sometimes fine copper, or brass filings, or mosaic gold, are mixed previously with some pulverized bone ash, and then applied in either way. A mixture of these powders with mucilage of gum arabic is used to give paper or wood a bronze appearance. The surface must be afterwards burnished. Copper powder, precipitated by clean plates of iron, from a solution of nitrate of copper, after being well washed and dried, has been employed in this way, either alone or mixed with pulverized bone ash. A finish is given to works of this nature by a coat of spirit varnish.

A white metallic appearance is given to plaster figures by rubbing over them an amalgam of equal parts of mercury, bismuth, and tin, and applying a coat of varnish over it. The iron coloured bronzing is given by black lead, or plumbago, finely pulverized and washed. Busts and other objects made of cast iron, acquire a bronze aspect by being well cleaned and plunged in a solution of sulphate of copper, whereby a thin film of this metal is left upon the iron.

Copper acquires, by a certain treatment, a reddish or yellowish hue, in consequence of a little oxide being formed upon its surface. Coins and medals may be handsomely bronzed as follows: 2 parts of verdigris and 1

part of sal ammoniac are to be dissolved in vinegar; the solution is to be boiled, skimmed, and diluted with water until it has only a weak metallic taste, and upon further dilution lets fall no white precipitate. This solution is made to boil briskly, and is poured upon the objects to be bronzed, which are previously made quite clean, particularly free from grease, and set in another copper pan. This pan is to be put upon the fire that the boiling may be renewed. The pieces under operation must be so laid that the solution has free access to every point of their surface. The copper hereby acquires an agreeable reddish brown hue, without losing its lustre. But if the process is too long continued, the coat of oxide becomes thick, and makes the objects appear scaly and dull. Hence they must be inspected every five minutes, and be taken out of the solution the moment their colour arrives at the desired shade. If the solution be too strong, the bronzing comes off with friction, or the copper gets covered with a white powder, which becomes green by exposure to air, and the labour is consequently lost. The bronzed pieces are to be washed with many repeated waters, and carefully dried, otherwise they would infallibly turn green. To give fresh made bronze objects an antique appearance, three-quarters of an ounce of sal ammoniac, and a dram and a half of binoxalate of potash (salt of sorrel) are to be dissolved in a quart of vinegar, and a soft rag, or brush, moistened with this solution, is to be rubbed over the clean bright metal, till its surface becomes entirely dry by the friction. This process must be repeated several times to produce the full effect; and the object should be kept a little warm. Copper acquires very readily a brown colour by rubbing it with a solution of the common liver of sulphur, or sulphuret of potash.

The Chinese are said to bronze their copper vessels by taking 2 ounces of verdigris, 2 ounces of cinnabar, 5 ounces of sal ammoniac, and 5 ounces of alum, all in powder, making them into a paste with vinegar, and spreading this pretty thick, like a pigment, on the surfaces previously brightened. The piece is then to be held a little while over a fire, till it becomes uniformly heated. It is next cooled, washed, and dried; after which it is treated in the same way once and again till the wished-for colour is obtained. An addition of sulphate of copper makes the colour incline more to chesnut brown, and of borax more to yellow. It is obvious that the cinnabar produces a thin coat of sulphuret of copper upon the surface of the vessel, and might probably be used with advantage by itself.—*Dr. Ure's Dictionary of Arts, &c.*

Lond Mech. Magazine.

Crystallization by Electricity.

A paper was read by Andrew Crosse, Esq., of Bromfield, Somerset, before the London Electrical Society, 19th of June, 1838, containing an account of a series of daily observations made with a sustaining battery, to ascertain the increase or diminution of the power of the same, as corresponding with the increase or diminution of the temperature of the atmosphere during a part of the last winter, and commenced previously to the very severe frost; and also a few remarks on the agency of heat, in electro-crystallization. As it is the intention of the Society to print this paper in their transactions, we can only briefly allude to the contents.

The observations on the sustaining battery are for a period of 28 days,

from the 23d December, 1837, to 19th January, 1838. The weekly average result is as follows:—

Gas collected.*		Average Temperature.	
First week	434°	a little above	50°
Second week	388°	not quite	46°
Third week	310½°	"	37°
Fourth week	306°	a little above	32°

There is, however, a singular fact connected with the above observations, viz. that on the last day, with the thermometer at 32°, with ice in all the cells, the quantity of gas obtained in the volameter was exactly the same as on the first day, when the thermometer was 50°.

In the experiments for the formation of crystals, Mr. Crosse tried the effects of heat in combination with voltaic electricity. The solutions were kept at the boiling point from one to six weeks, the solutions being constantly replaced as they evaporated, which, in some instances, exceeded 7 gallons in every 24 hours.

Mr. Crosse exhibited several specimens of the crystals, chiefly of copper and its compounds. Taking up one, Mr. Crosse said, this is iridiscent copper ore, produced in eight months by this simple process. When the negative and positive cells contain sulphate of copper and muriate of ammonia, crystals of various kinds are formed. If the process of crystallization be carried on in the dark, with hot solutions and water, there will not be any cessation of action: but in the usual way of experimenting, there seems to be a point at which crystallization stops. He produced a specimen (formed in the absence of light) of red oxide of copper, in crystals perfectly octohedral, which he considers to be very rare in nature. Mr. Crosse stated that six sided prisms of carbonate of lime, attached to a coil of wire suspended in a glass vessel, were destroyed when exposed to the light.

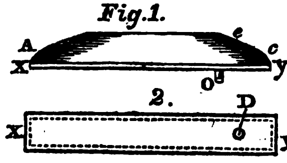
Mr. Crosse is inclined to think, from a series of experiments which he is at present making, that fissures in the earth are caused by electrical action, and that, in all probability, every description of gems, found in the earth, can be formed by the union of pressure, heat, electricity, and absence of light.

Annals Electr.

On a Water Cushion for Electrical Machines. *By* C. V. Walker.

In common with other electricians, I have felt the inconvenience arising from the want of uniformity in the shape of glass cylinders for the electrical machine. Chancing to have one, which was very irregular, and finding the inefficiency of the common cushion, (for while at times it exerted a strong pressure, at other times it exerted no pressure at all) I was led to adopt the arrangement of which fig. 1 is a section, and fig. 2 a back view. A, B, C, is a cushion formed of Indian rubber, and covered with wash leather, presenting to the cylinder a surface A, B, C. It is filled with water, by means of a condensing syringe, through a valve D, at the back. To give strength, the side A, C,

Fig.1.



* Mr. Crosse collected the liberated gases in a cylindrical glass tube, graduated into equal parts, which are here called degrees.

is attached to a metal plate *x*, *y*, by passing a needle, with stout thread, through the leather cover and through holes drilled in the edge of the plate, as seen in fig. 2.

The amalgam is not applied to the cushion itself, but to a silk flap attached to its lower edge, and passing between it and the cylinder.

The free motion of the particles of water among themselves rendered this a great acquisition, for it accommodates itself so as always to present the requisite pressure to the revolving cylinder. Should any of your readers object to it on account of water being present, I would say, that the experience of two years satisfies me that no dampness originates from that source; and this results from the Indian rubber being water proof, and the valve water tight.

The merit of inventing the water cushion is due to Mr. T. Forster, 14 Basing Lane, who applied it to a purpose in surgery; but, on my suggesting that it would be a desirable substitute in place of the usual rubber of the machine, he kindly arranged one as above, which answers every expectation.

Idem.

On Electro-Magnetic Coil Machines. *By* Uriah Clarke.

I have made an experiment, which is, I think, calculated to support the opinion of some recent theorists, that the earth acquires and maintains its polarity by galvanic agency; to effect this experiment, a globular battery is first constructed in the following manner: by passing right through the centre of a hollow copper sphere of four or five inches diameter, a tube of zinc of one inch diameter, in which tube of zinc is placed a bar of soft iron, having upon it a helical coil of covered copper wire, one end of which wire is soldered to the zinc tube and the other end to the copper globe. Care must be taken that the zinc and copper do not touch each other, but the joining must be made good by sealing wax or some other non-conducting substance; a saturated solution of common salt is then to be poured into the globe, and the globe suspended by means of an agate cap, or floated in a vessel of water, and it will immediately indicate polarity, arranging itself in the magnetic meridian. Pour out the salt water, and the effect of course ceases. If we may assume that there is any analogy between the action of the salt water on the metals of this little globe and that of the waters of the ocean upon the metallic strata of the earth, are we not at once furnished with a grand final cause for the saltness, as well as the vastness, of the waters of the sea?

Idem.

Constant Galvanic Battery. By Professor J. F. Daniell, *in a Letter to Dr. Faraday.*

I have just completed a *constant battery* of large dimensions, the effects of which exceed my most sanguine expectations, and open new views of the possible application of the extraordinary powers of the voltaic current to economical purposes. It consists of only ten copper cells 20 inches high, $3\frac{1}{2}$ inches diameter, as in the first battery. The interior partitions are formed by merely tying the open ends of oxen's gullets to the rings of the colanders for supporting the sulphate of copper, and which are made deeper than before, and suspending them in the cells, to the bottoms of which they reach. These membranous bags contain each rather more

than a quart of the dilute acid. The zinc rods are of the diameter of $\frac{5}{8}$th of an inch, well amalgamated, and the connections are made as before described. At the temperature of 67° this battery produces, in the voltameters which I have all along employed in these researches, 12 cubic inches of the mixed gases per minute, or 720 cubic inches per hour. Its powers of ignition are very great; and while it will maintain 6 inches of platinum wire $\frac{1}{100}$th of an inch diameter red hot, it will still decompose water at the rate of 14 cubic inches per five minutes. The permanence of this result is very striking.

When the battery is not in use the rods are taken out and wiped, and the membranous bags carefully lifted out of the cells, emptied of their acid, filled with water, and suspended from a frame placed for their reception. By this treatment I do not find that they are liable to any change of texture or deterioration; and I have now membranes which have been in use for several months and are quite perfect. If the acid be perfectly washed out of them they may even be dried with impunity; but it is better to preserve them in a moist state, as when dry they are liable to crack. The acid solution of sulphate of copper remains in the cells without injury, and in ten minutes the battery, when required, may be brought into action. There is no reason to think that the limits of efficiency have yet been nearly attained, and the gullets could easily be connected together so as to obtain bags of any required length. I scarcely, however, think that in simplicity and cheapness of construction, the battery can be further improved. Ibid.

Kindling Phosphorus by a discharge from a common electrical jar.

I. Dr. Boettger finds that if on discharging the jar there was *no* interruption between one knob of the discharging rod and the knob in connection with the internal coating of the jar, in other words if I laid the knob of the discharging rod *directly* upon the knob of the jar and then pursued precisely the course stated above,* the phosphorus became ignited *every time* when the jar was charged with *positive* electricity, the phosphorus being stuck on to the needle connected with the outer coating, and either the knob or the point of the discharging rod being suddenly brought near it. On the contrary, if I stuck it on to the point of the discharging rod and brought the latter close, either to the point or the knob of the steel needle, it was *never* ignited when the jar was *full charged.* When the jar, however, contained merely a very weak charge, a single spark of an inch long for instance, drawn from the prime conductor, the phosphorus was ignited *every time.*

II. On charging the jar with *negative* electricity precisely the reverse was obtained. That is to say, the phosphorus, when stuck on to the steel needle connected with the outer coating, was *not ignited* by a *high charge;* but it took fire *every time* when stuck on to the point of the discharging rod, or when the jar, as in the above experiment, was charged with but a single weak spark. It cannot but be considered a remarkable phenomenon that the phosphorus *never* became ignited when treated as described in I., but on the contrary that it *always* was so with a *full* charge of *positive* electricity when treated as in II., the phosphorus being in connexion with the *nega-*

*Alluding to an arrangement in which a needle, passing through a glass tube, was connected with the outside coating of the jar. The phosphorus was quite dry, and in pieces about as large as a pin's head. The discharging rods ended in fine points, on which small brass knobs could be screwed. G.

tive coating. And that with a *negative charge* if the phosphorus was in connexion with the *negatively charged knob of the jar*, it was always inflamed, while it *never* was in the other case, though it was so if the jar was charged with simply a very weak spark taken from the conductor of the machine. It is desirable that some person who has more spare time than I can command, should follow up experimentally, what is here mentioned in a general way only. Ibid.

Substitute for Mountain Barometers.

Sir,—In the selections that have been published from the proceedings of the British Association, at Newcastle, there is an account of a substitute for mountain barometers proposed by Sir John Robison, secretary of the Royal Society of Edinburgh. As considerable errors appear to have crept into the reports regarding this instrument, I deem it worth while to describe more fully its real character, premising that it is much simpler and more easily managed by unskilled travellers, than the description given at page 469 of your last volume would lead persons to suppose.

The instrument exhibited at the meeting consisted of a glass tube, about 1.25 inches diameter, and about 14 inches long, with a small bulb at the end. The capacity of the bulb appeared to be three or four times that of the inside of the tube. The stem of the tube was graduated by divisions, which had been experimentally formed by the instrument maker, in the following way:—At a time when ~~the mercurial barometer was~~ at 30 inches, and Fahrenheit's thermometer at 62°, the instrument was suspended within the receiver of an air pump, over a cup containing water; the air in the receiver being exhausted to a degree of rarefaction corresponding to 29 inches of the barometer, the instrument was then lowered until its lower end was immersed in the cup of water; air being admitted into the receiver, the water rose in the tube of the instrument, and its height was carefully marked. The instrument was again suspended in the receiver, and the exhaustion repeated until the barometer gauge indicated 28 inches; the immersion in the cup was then made, and a second mark put upon the stem. By continuing this process, the graduation of the stem was carried on as far as was thought requisite, when the instrument became ready for use.

It will be evident on reflection, that with a number of tubes graduated in this manner, a traveller arriving at a station in the midst of mountains may ascertain the tension of the air on the summits of all of them, by sending a messenger to each, with one or more of these tubes, and a tin case containing a little water. The messenger taking up the tubes with their stems open, the air within them partakes of the density of the atmosphere at the station visited, and if, when at the summit, the mouth of the tube is put into the water, and left in it while the messenger descends, the water will rise in the stem with the increasing density of the atmosphere, and will indicate, by its height, the degree of rarefaction of the air at the upper station, if the barometer at the lower one stands at 30 inches; if it be more, or less, a corresponding correction must be made for the difference.

If the temperature of the air at the upper and lower stations was the same, nothing further would require to be done; but as this will seldom or never be the case, unless the instrument at both stations can be put into water containing melting snow, it is necessary, where accuracy is required, to send up a thermometer with the messenger, that the temperature of the

instrument at the upper station may be noted, and a correction made for any difference that is observed between that and the one at the lower station.

This instrument is equally adapted for the use of æronauts, and will, I have no doubt, be very advantageously employed for many other purposes; ingenious in design, beautifully simple in its construction, accurate in its results, extremely portable, and easily managed, it strongly recommends itself to scientific tourists, &c. as a valuable addenda to their more costly apparatus. I remain, Sir, Yours respectfully,

WILLIAM BADDELEY.

London, October 23, 1838. Lond. Mech. Mag.

Important Improvements in Stocking Weaving.

Our townsman, Mr. Robert Scott, has invented some ingenious machinery for working the stocking frame, which (though since the time of its original invention it has remained *in statu quo*) is now placed in the first rank of improvements, inasmuch as, prior to Mr. Scott's machine, a man could not manufacture more than 24 pairs per week, while this invention will enable a man and boy to produce 20 pairs per hour, or 100 dozens per week! The perfecting of this machine has been a work of immense labour, time, and capital, and reflects the highest credit on the ingenuity and perseverance of its talented inventor, and we confess we regret exceedingly that any thing should deprive him of his due reward. "It may be questioned, however," says a correspondent, "whether the advantages resulting from the present form of the machine, distributing the labour to all branches of the family of the poor, in their cottages, are not greater than those obtained by attaching it to steam power, and congregating the weavers in large factories. The time may come, indeed, when this may be the best form of employing labour, but it is at present accompanied with inconveniences of no trifling amount. The progress of mechanical invention, however, cannot be stayed by these advantages. We must avail ourselves of improvements as they arise, rather than suffer other districts, by adopting them, to rob us of that ancient inheritance, our stocking manufacture. The worsted branch of the hosiery trade has been so long established in this county, that we should look with suspicion upon any improvements of machinery adopted by other counties, before they are brought into actual competition. Several patents have, we understand, been obtained at Nottingham, for power stocking frames, of which the Nottingham papers have spoken very highly, and which, most likely, will result in something being done, though we are informed that all of them are much inferior in speed to the invention of Mr. Scott, whose improvements in the mode of working the common frame render it capable of being attached to power whenever the wants of the trade or the competition of our neighbours may render it necessary. The chief advantages of his plan are the rendering the labour of working a frame much easier and pleasanter when applied to hand labour, and the attainment of a speed greater than any other invention; the expense when attached to steam power, being small, and the wear and tear being less than by hand." Mr. Scott's engagement in another county prevents his further carrying out his intentions with respect to them; and he therefore purposes to sell his machines by auction, which will, no doubt, excite very considerable interest and competition.—*Leicestershire Mercury.* Ibid.

Progress of Physical Science.

Short Account of some Researches upon the Variations which take place at certain Times of the Day in the temperature of the Lower Strata of the Atmosphere. By Professor Marcet.*

The author first examines the observations which had previously been made upon this subject, and more particularly those of M. Pictet, and of the English naturalist Six, undertaken towards the close of the last century. After demonstrating that the observations of these philosophers are not sufficient, in a satisfactory manner, to resolve the different inquiries which present themselves, the author proceeds to the description of the apparatus which he himself employed in the prosecution of the subject.

This apparatus consists in a mast 114 feet high, composed of two spars of fir, accurately connected with each other; divers precautions being taken that they should not be broken or overturned by the violence of the wind. It was placed in the most favourable situation for experiments of this kind, that is to say, in the midst of a great field, at a considerable distance from all habitations. The author adjusted, at the distance of every ten feet throughout the whole length of the mast, horizontal pieces of wood, to the extremity of which was attached a little pulley, by means of which the thermometers might be made to ascend and descend. The thermometers employed had their bulbs well covered with some good non-conducting substance, so that it might be certain their temperature did not vary during the time of their descent. Accurate notation was made, at the moment of every observation, of the meteorological condition of the atmosphere, and, in particular, of the indications of the hygrometer and of the ethrioscope.

The principal object which the author had in view in his researches may be regarded as a solution of the four following questions:—1st. To what extent the increase of temperature, which has been observed in proportion to elevation during certain periods of the day, is influenced by the condition of the sky, and the agitation of the air. To determine, 2dly, in a precise way, at what periods of the day this increase of temperature becomes perceptible; if it remain constant, or if it have a tendency to increase during the night? 3dly. Does the limit of elevation, at which this increase of temperature ceases, remain constant, or does it vary according to the meteorological state of the atmosphere? And 4thly. Whether the increase of temperature as well as the limit of its elevation, remain constant, or vary according to the different seasons of the year?

The author discusses these four questions successively, and gives an account of his various observations, which were all made during the year 1837, and the two first months of 1838. The results obtained have led to the following conclusions:

1st. The increase of temperature as you ascend, which is most conspicuous at the setting of the sun, however variable it may be, whether as regards its intensity, or its limit of elevation, is a constant phenomenon, whatever may be the condition of the sky; with the single exception of violent winds.†

* La Soc. de Phy. et d'Hist. Nat. de Geneve. March, 1838.

† The author establishes, by a great number of observations, that the phenomenon is not confined to those occasions in which the sky is clear and serene, as had hitherto been supposed. It also exists, though in a less degree, even when the sky is overcast; excepting always the periods of violent winds.

2d. The period of the maximum of this increase is that immediately following the setting of the sun. Starting from this time it remains stationary, or even frequently diminishes, especially when the dew is abundant.* At the time of sunrise, the increase is most frequently less than it was at sunset.

3d. The limit of elevation to which the increase of temperature extends, appears rarely to surpass the height of 100 feet, even when the sky is perfectly clear and serene. When it is very cloudy, and especially in winter, this limit is much lower.

4th. The increase of temperature in ascending, varies, both according to its intensity, and as to the limits of its elevation, according to the different seasons of the year. It is especially during the winter, and when the surface is covered with snow, that this phenomenon presents the most remarkable results.

The extraordinary severity of the last winter, enabled the author to make many observations upon the remarkable difference which may exist between the temperature of different strata of the air, but little separated from each other. The maximum of this difference amounted, on the 20th of January, to 14°.4 of Fahr. on a change of elevation of 50 feet. A thermometer placed at the height of two feet above the surface, indicating 3° Fahr., and another at the height of 52 feet, indicating at the same moment 17°.4. The mean difference, calculating upon twelve observations made during the period of excessive cold, between the temperature of two strata of air separated by an interval of 50 feet, was 10° Fahr. These differences were much less conspicuous during fine weather.

The comparison between the temperature of the air at *two* feet, and at *five* feet above the surface, perhaps presented still more remarkable results than the preceding, regard being had to their great proximity. The difference, calculating from the mean of nine observations (the surface being then covered with snow,) was 4°.2 in favour of the more elevated station; this difference, on the 4th of January, increased to 7°.2 Fahr.

A great number of trees in the neighbourhood of Geneva have suffered this winter from the intensity of the frost. The gardeners have remarked in many instances, that the lower part of the tree was frozen, whilst the upper branches remained perfectly uninjured. Localities even have been named where a great number of the trees were found frozen to the height of four or five feet, and remained green above this limit. The facts contained in this memoir of M. Marcet serve to account for these apparent anomalies.

Edin. New Philos. Journ.

British Association on Halley's Comet. *By Sir* J. Herschell.

One of the most interesting series of observations, of a miscellaneous kind, I had to make at the Cape of Good Hope, was that of Halley's comet. This comet is the great glory of modern calculation. To see the predicted return of such a body now verified for the second time, true to a single day,—nay, to a few hours—of his appointed time, after an absence of

* The author has almost constantly observed that an abundant descent of dew has a tendency to raise the heat of the strata of air which are nearest to the earth, and, consequently, to re-establish, to a certain point, an equilibrium between these strata and the superior ones.

seventy-five or seventy-six years, during which it has been subjected to the unceasing perturbations of all the planets, and especially persecuted by Jupiter and Saturn, those great stumbling blocks of comets, is really superb. However, what I have now to relate refers to a very singular and instructive fact in its physical history. I saw the comet for the first time, after its perihelion passage, on the night of the 25th of January. Mr. Maclear saw it on the 24th. From this time we, of course, both observed it regularly. Its appearance at first was that of a round, well-defined disc, having near its centre a very small bright object exactly like a small comet, and surrounded by a faint nebula. This nebula, in two or three more nights, was absorbed into the disc, and disappeared entirely. Meanwhile, the disc itself dilated with extraordinary rapidity, and by measuring its diameter at every favorable opportunity, and laying down the measures by a projected curve, I found the curve to be very nearly a straight line, indicating a uniform rate of increase; and by tracing back this line to its intersection with its axis, I was led, at the time, to this very singular conclusion,—viz. that on the 21st of January, at 2h. P. M., the disc must have been a point—or ought to have no magnitude at all! in other words, at that precise epoch some very remarkable change in the physical condition of the comet must have commenced. Well! all this was speculation. But here comes the matter of fact I refer to, and which, observe, was communicated to me no longer ago than last month by the venerable Olbers, whom I visited in my passage through Bremen, and who was so good as to show me a letter he had just received from M. Boguslawski, Professor of Astronomy at Breslau, in which he states that he had actually procured an observation of that comet on the night of the 21st of January. Well then, how did it appear? why, as a star of the sixth magnitude—a bright concentrated point, which showed no disc, with a magnifying power of 140! And that it actually *was* the comet, and no star, he satisfied himself, by turning his telescope on that point where he had seen it. It was gone! Moreover, he had taken care to secure, by actual observation, the place of the star he observed; that place agreed to exact precision with his computation: that star *was* the comet, in short. Now, I think this observation every way remarkable. First, it is remarkable for the fact, that M. Boguslawski was *able* to observe it at all on the 21st. This could not have been done, had he not been able to direct his telescope point blank on the spot, by calculation, since it would have been impossible in any other way to have known it from a star. And, in fact, it was this very thing which caused Maclear and myself to miss procuring earlier observations. I am sure that I must often have swept, with a night-glass, over the very spot where it stood in the morning before sunrise. And never was astonishment greater than mine at seeing it riding high in the sky, broadly visible to the naked eye, when pointed out to me by Mr. Maclear, who saw it with no less amazement on the 24th. The next remarkable feature, is the enormously rapid rate of dilatation of the disc and the absorption into it of all trace of the surrounding nebula. Another is the interior cometic nucleus. All these phenomena, while they contradict every other hypothesis that has ever been advanced, so far as I can see, are quite in accordance with a theory on the subject, which I suggested on the occasion of some observations of Biela's comet,—a theory which sets out from the analogy of the precipitation of mists and dews from a state of transparent vapor on the abstraction of heat. It appears to me, that the nucleus and grosser parts of the comet must have been entirely evaporated during its perihelion, and reprecipitated

during its recess from the sun, as it came into a colder region; and that the first moment of this precipitation was precisely that I have pointed out as the limit of the existence of the disc,—viz. on the 21st of January, at 2 P. M., or perhaps an hour or two later.

Athenæum.

On some Preparations of the Eye. By Mr. Clay Wallace, *of New York.*

Sir David Brewster laid before the Section a series of beautiful preparations of the eye, made by Mr. Clay Wallace, an able oculist in New York, calculated to establish some important points in the theory of vision. As no paper accompanied these preparations, which had reached him at Newcastle, Sir David Brewster explained to the meeting their general nature and importance. Mr. Clay Wallace, he stated, considers that he has discovered the apparatus by which the eye is adjusted to different distances. This adjustment is, he conceives, effected in two ways,—in eyes which have *spherical lenses* it is produced by a *falciform,* or hook-shaped muscle attached only to one side of the lens, which by its construction brings the crystalline lens nearer the retina. In this case, it is obvious that the lens will have a slight motion of rotation, and that the diameter, which was in the axis of vision previous to the contraction of the muscle, will be moved out of that axis after the adjustment, so that at different distances of the lens from the retina different diameters of it will be placed in the axis of vision. As the diameters of a sphere are all equal and similar, Mr. Clay Wallace considered that vision would be equally perfect along the different diameters of the lens, brought by rotation into the axis of vision. Sir David Brewster, however, remarked that he had never found among his numerous examinations of the lenses of fishes any which are perfectly spherical, as they were all either *oblate* or *prolate* spheroids, so that along the different diameters of the solid lens the vision would not be similarly performed. But independent of this circumstance, he stated that in every solid lens there was only one line or axis in which vision could be perfectly distinct, namely, the axis of the optical figure, or series of *positive* and *negative* luminous sectors, which are seen by the analysis of polarized light. Along every other diameter the optical action of the lens is not symmetrical. When the lens is not a *sphere,* but *lenticular,* as in the human eye or in the eyes of most quadrupeds, Mr. Clay Wallace considers that the apparatus for adjustment is the ciliary processes, to which this office had been previously ascribed, though not on the same scientific grounds as those discovered by Mr. Wallace. One of the most important results of Mr. Wallace's dissections is the discovery of *fibres in the retina.* These fibres may be rendered distinctly visible. They diverge from the base of the optic nerve, and surround the *foramen ovale* of Soemmering at the extremity of the eye. Sir John Herschel had supposed such fibres to be requisite in the explanation of the theory of vision, and it is therefore doubly interesting to find that they have been actually discovered. Sir David Brewster concluded his observations by expressing a hope that anatomists in this country would turn their attention to this subject; and that with this view he would place the preparations of Mr. Clay Wallace in the Exhibition Rooms at Newcastle during the week.

Ibid.

Note on the Structure of the Vitreous Humour of the Eye of a Shark. *By* Sir J. Herschel.

While crossing the Atlantic, on my return from the Cape, on the 31st of March of the present year, in lat. about 2° N., lon. about 20° W., we caught a shark. Having procured the eyes, which were very large, and extracted the crystalline lenses, the vitreous humour of each, in its capsule, presented the usual appearance of a very clear, transparent, gelatinous mass, of little consistency, but yet forming, very distinctly, a connected and continuous body, easily separable from every other part. Wishing to examine it more narrowly, it was laid to drain on blotting-paper; and, as this grew saturated, more was applied, till it became apparent that the supply of watery liquid was much too great to be accounted for by adhering water or aqueous humour. Becoming curious to know to what extent the drainage might go, and expecting to find that, by carrying it to its limit, a gelatinous principle of much higher consistency might be insulated, I pierced it in various directions with a pointed instrument. At every thrust, a flow of liquid, somewhat ropy, but decidedly not gelatinous, emanated; and, by suspending it on a fork, and stabbing it in all directions with another, this liquid flowed so abundantly, as led me to conclude that the gelatinous appearance of this humour, in its natural state, is a mere illusion, and that, in fact, it consisted of a liquid no way gelatinous, inclosed in a structure of transparent, and, consequently, invisible cells. The vitreous humour of the other eye, insulated as far as possible, was therefore placed in a saucer, and beaten up with a fork, in the manner of an egg beaten up for culinary purposes. By this operation, the whole was resolved into a clear watery liquid, in which delicate membranous flocks could be perceived, and drawn out from the water in thready filaments, on the end of the fork. From this experiment, it is clear, that the vitreous humour (so called) of this fish is no jelly, but simply a clear liquid, inclosed in some close cellular structure of transparent membranous bags, which, by their obstruction to the free movements of the contained liquid, imitate the gelatinous state.

Sir D. Brewster observed, that he had frequently found the vitreous humours of fishes' eyes to exhibit the greatest variety of color—green, rose-pink, &c.

Ibid.

Water Spouts.

The connexion of water spouts with electro-magnetism, a favourite subject with some German naturalists, has been brought forward by Col. Reid in his memoir on storms, read before the British Association, and we hope it will not be lost sight of. The double cones in water spouts, one pointing upwards from the sea, the other downwards from the clouds, are interesting features in the phenomenon; these ought to be more particularly examined, and we should also ascertain whether the cloud above and the sea below revolve in the same direction with each other. We also suggest to those who may have an opportunity, to examine whether the rain which the spout projects in all directions is salt or fresh.

Edin. New Philos. Journ.

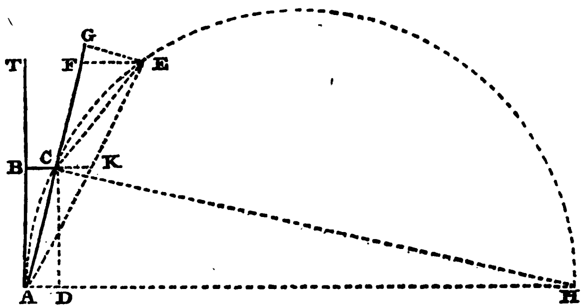
Fall of Rain from a Serene Sky.

Mr. Wartmann has informed M. Arago, that on the 31st day of May last, at two minutes after seven o'clock in the evening, there was a shower at Geneva, which lasted six minutes, the sky being perfectly clear at the zenith, and no cloud being visible in the neighbourhood of the place. This rain, whose temperature was lukewarm, fell vertically in drops, at first large and numerous, and gradually became smaller and smaller till it ceased. The thermometer at the time indicated a temperature of 65°.5 Fahr. The day had been one of frequent showers and sunshine.

Phenomena of the above kind, as well as others of an extraordinary character, dependent on peculiar states of the atmosphere, should be noticed by every meteorologist, in connexion with the indications of the barometer. G.

Progress of Civil Engineering.

Setting out Curves on Railways.



Sir,—Permit me, through the medium of your Journal, to call the attention of engineers on railways to the very erroneous method many of them adopt in setting out the curves, which, if intended to be segments of circular arcs—ought certainly to be so.

Of course it must be generally known, from the great radii of even the least of the curves on railways—it would be impracticable to strike them, as in the usual manner, from a fixed centre; but from the known relation between the sine and versed sine of an arc, the same object may be simply and expeditiously effected;—for instance, let A T be a tangent to the required curve at the point A; upon A T measure off any convenient length, A B, and from B draw B C perpendicular to A B = to the versed sine of an arc, whose sine is equal to A B, the point C is the locus of the curve at that point; for it is obvious, that A B = C D the sine of the arc A C; and B C = A D its versed sine; and this operation may be pursued to any convenient distance by continually increasing the sine and versed sine, thereby obtaining so many more points in the curve required. The formula for determining the versed sine A D. is of easy application, viz. $A\,D = \text{Rad} - \sqrt{\text{Rad}^2 - \sin^2}$. And, moreover, since the curvatures of circles vary inverse-

ly as their radii, when we have the versed sine of one arc, we may easily obtain the versed sine of arcs of any radii, without even the repetition of the above formula. Now, however simple this process may appear, many, in endeavouring to arrive at a higher degree of simplicity, adopt the following inaccurate method, by which the curves are any thing but what they are intended to be, and this I will endeavour to show:—

Let A C E be the proposed circular arc of a given radius, A T its tangent at the point A. Upon A T is taken any part A B, and from B is drawn B C $= \left(\frac{AB^2}{\text{diam.}}\right)$ perpendicular to A B, then the chord A C is produced to G, making C G = to A B, and from G is drawn the perpendicular G E = 2 B C, and the points A, C, E, are assumed as being in the circumference of the same circle, and other points in the circumference are found by producing the chord C E in the same manner as was before done with the chord A C, and drawing new perpendiculars each = to 2 B. C.

Now it may easily be proved, that not only the data by which the value of B C is assumed are incorrect, but that the curve thus determined is very far from being circular; on the contrary, it is one in which the radius of curvature is continually increasing.

Produce B C to K, and draw F E parallel to B K, join C H, A E and C E.

1st, It is evident that $\frac{AB^2}{\text{diam. }(AH)}$ is not equal to B C or A D, for (Cor. 8th Euc. 6th.)

$$AH : AC :: AC : AD$$
$$\therefore AD \times AH = AC^2$$
$$AD \text{ or } BC = \frac{AC^2}{AH}.$$

And A C is greater than A B, being the hypothenuse of the right $\triangle$ A B C. However, here the error is very trifling, if the sine be small in comparison with the rad.; but strictly speaking it is incorrect, and in circles of small radii the incorrectness would be serious.

2ndly, Where G E is assumed to be = to 2 B C is decidedly wrong. For (Euc. 32d 3rd b.) $<$ B A C = $<$ A E C; but in $\triangle$ G C E the $<$ G C E = two interior and opposite angles C A E and C E A (Euc. 32nd, 1st b.) $\therefore \angle$ G C E = $\angle$ B A E. Now the two $\triangle$s B A K, G C E are similar and equal; wherefore, (Euc. 26th, 1st b.) G E = B K. Again, since in $\triangle$ A F E, C K is parallel to F E, A F : A C :: F E : C K (Euc. 2nd, b. 6th;) but A F is less than 2 A C $\therefore$ F E is less than 2 C K—much more than is G E or its = B K less than 2 C K (since F E is the hyh. of the right angled $\triangle$ G F E.) And as B K is divided into two parts B C, C K, if the whole B K be much less than twice one portion C K, it evidently must be much greater than twice the other B C $\therefore$ B K or G E is much more than 2 B C; therefore, admitting the locus of the point C to be on the circumference of a circle of the given radius, the point E is not, if G E is made = to 2 B C—Q. E. D.

Trusting that this communication may not be without interest to some of your readers, I beg to subscribe myself, Sir, yours faithfully,

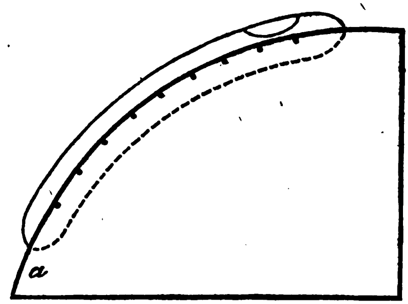
$\triangle$.

October 5, 1838.

Lond. Mech. Mag.

Notice of an Instrument to be used in Land Surveying, for reducing the Length of Lines over Undulating Surfaces to the Length of the Base, or Level Line. By RICHARD VARDEN, *Architect.*

The instrument which I am about to describe is of considerable service to persons engaged on parish, or other large, surveys, for allowancing their measuring chain on hilly ground; and, as it is but little known, you may like to have some account of it in the Architectural Magazine. It was invented by the late Mr. Webb of Salisbury, a surveyor of eminence, who invented and manufactured many of his own instruments, and his grandson, who made me acquainted with it, continues the use of it, as do several other surveyors in this neighbourhood, all of whom find it of material service. It consists of a wooden quadrant, 5 in. long, and 1 in. thick, let into the curved edge of which is a bent glass tube, nearly filled with spirit, and hermetically closed. The edge of the quadrant is covered with a plate of brass, divided in a manner similar to the scale for ascertaining the difference between a base and hypothenuse line which are on most theodolites. The mode of using it is, to place the bottom, or flat part, on an offset staff, laid parallel with the surface of the ground, the point *a*, being towards the ascent. Thus placed, the air bubble in the tube will stand against the figured brass scale, and indicate the number of links that must be added to every chain's length for that inclination. This allowance is to reduce the length of lines measured over sloping or undulating ground, to the length of the base, or level line, and is necessary in every survey, as the base of the land, and not the surface, is to be computed.



Worcester, Oct. 19, 1838. Arch. Mag.

Trial of Anthracite Coal.

We understand that on yesterday week, a trial was made on the Liverpool and Manchester Railway, of the applicability of anthracite coal as a fuel for locomotive engines, under the superintendence of Mr. Woods, the talented engineer of that line, and with the approbation of the board of directors. Mr. E. D. Manby, an engineer connected with the South Wales anthracite district, who has devoted his attention most successfully to the introduction of this fuel, was present, and assisted in the trial.

The engine employed was the Vulcan, one of the smaller engines, used for conveying goods. The general result of the trial was highly satisfactory. In the first instance, the engine ran out without a load about six miles, and the coal was found to do very good duty, without any difficulty being experienced either with the tubes or in getting up the fires. It was noticed that the fuel burnt nearly without dust from the chimney, and entirely without smoke. The engine brought back a load of coal wagons

from the Hayton colliery, and acquired a speed, thus loaded, of twenty-one miles an hour, which is about the duty of the Vulcan.

Another trial was made in the evening, with the same engine, for the whole distance to Manchester, taking five loaded wagons. The journey was performed in one hour and twenty-nine minutes. The consumption of anthracite was only five and a half cwt., although a large portion was wasted from the fire bars being too wide apart for the economical use of this fuel. The engine would have used upwards of seven and half cwt. of coke for the same journey, with the same load.

We regard the success of this trial as likely to prove, in its result, a most important public benefit. The price of coke, as the demand for it for use in locomotive engines, or railways, has extended, has increased, in some places, almost 50 per cent.; and in districts which produce no coal, this enhanced price of coke will be seriously prejudicial to the success of railway undertakings. If anthracite can be generally applied to locomotive engines, we are given to understand that a saving of 30 to 40 per cent. in cost and quality will be effected. We have no doubt that the directors of our leading railways will instruct their engineers to follow up these experiments, and introduce such modifications into the form and workings of the fire boxes as the use of a new fuel may naturally be supposed to require.

The application of anthracite to marine engines is the next object most deserving the attention of practical men. The journalists of the United States appear to claim for their country almost the exclusive production of this invaluable fuel, which is destined to play so great a part in the iron manufacture, in railway locomotion, and in steam navigation; but the western part of the South Wales coal field, with reference to which Liverpool is, geographically, so favourably situated, contains stores of anthracite of much superior quality to those specimens from America which we have seen, and can produce it at a much smaller cost.—*Glamorgan Gaz.*

Mining Journ.

On the Limestone, the Lime Cement, and Method of Blasting, in the neighbourhood of Plymouth. By W. Stuart, *M. Inst. C. E.*

Plymouth abounds in limestone, which may be raised in solid masses of from three to ten tons; it is used most extensively for building and for lime manure. About 13 cubic feet weigh a ton; the limestone is of a light blue or gray colour, in general free from metallic veins, but with some indications of manganese and iron stone, round pieces of the latter being found in clay beds, intermixed with the rock, and a vein of iron stone four inches thick at the surface of the rock, and dipping towards the south, has been opened.

The author then proceeds to describe the general method of making cement in that neighbourhood, and the method which he has employed with considerable advantage.

The bit, or iron rod, called a jumper, is generally used. In pitching a deep hole, a two-inch bit is used for about four feet, and a $1\frac{7}{8}$-inch for the next four feet, by one man; then two men are employed with $1\frac{3}{4}$-inch to the depth of 14 feet, and $1\frac{5}{8}$-inch to the depth of 21 feet. A constant supply of water is required during boring the hole. The hole being well dried, about one-third is filled with powder, say 15 lbs.; a needle is introduced as

far as possible without driving it; the hole is tamped with dry clay to the top, and then covered with a little wet clay, to prevent any of the loose particles falling in when the needle is withdrawn. A reed filled with powder, and split at the top, to prevent its falling to the bottom of the hole, is inserted, and a stone laid upon it; the powder being ignited by a piece of touch paper and a train, the reed flies to the bottom of the hole, and ignites the main load. The rock is generally cracked and loosened to a considerable extent, if not thrown; in that case, the needle is driven through the tamping, and such a fresh charge is run through the needle hole as may be requisite. From six to eight tons of rock are generally blasted with one cwt. of gunpowder. The paper is accompanied with drawings of the jumpers, the tamping bar, the needle, and the discharging reed. Jour. Arts & Sci.

Mechanics' Register.

Caoutchouc Tree.

This substance being now used for so many important purposes, perhaps the following account of the majestic tree which produces it may prove interesting.

The caoutchouc is generally a solitary tree, although occasionally two or three may be found together. It is among the most magnificent of forest trees, and is only second to the banyan, because that tree admits of indefinite extension. Such is the size of the caoutchouc, that it may be distinguished from a distance of several miles by its dense and lofty crown. The dimensions of one of the largest are as follows:—the circumference of the main trunk, 74 feet; of the main trunk and the supporters, 120 feet; and of the area covered by the branches, 610 feet, more than a tenth of a mile! the height is 100 feet. The appearance of the tree is majestic. It throws out shoots both from the main trunk and from the branches, and these often cohere with the trunk and with each other. When more are thrown out from the main trunk, or near it, they sometimes run down its surface, and impart to it the picturesque appearance of the most elaborate sculpture. Frequently the caoutchouc plants itself on other trees, and as soon as it is firmly fixed, casts down its roots to the ground. These seek each other; a net work is soon formed, which at length grows into a solid and firm cylinder round the tree which received the young seedling, and is eventually stifled in the embrace of the caoutchouc. The juice is procured from transverse incisions in the large root. The incision penetrates the wood, but the flow of juice is from the bark alone. Under the incision a hole is scooped in the earth, in which a leaf, folded up like a cup, is placed. The fluid, when good, is nearly of the consistence of cream, and of a very fine white colour. Many incisions are made in one tree; the juice flows rapidly at first, but diminishes in a few moments. It flows more copiously during the night. In two or three days a layer of caoutchouc is formed over the wound, and the flowing ceases.—*Friend in India.* Min. Journ.

New Mines in Egypt.

The Pacha of Egypt may find some consolation for the loss of his monopoly in the general speculation forced on him by the treaty between England and

Turkey, in the recent discovery of gold mines in Upper Egypt, the product of which is reputed to have turned out even more rich than was originally supposed. A vein of silver, extremely rich, is stated to have been discovered at Königsberg, the old capital of Prussia. The "Precurseur," a journal published at Antwerp, announces that a mine of iron ore has lately been discovered at Capellen, in the province of Antwerp, of a quality superior to that imported from England. It is being worked with activity, and some boat loads have already been sent to Charleroi. Lond. Mech. Mag.

Presentation of Plate to Dr. Gregory.

Our readers are aware that Dr. Gregory resigned his appointment as Professor of Mathematics at the Royal Military Academy, Woolwich, in June last. We have just learnt that the company of gentlemen cadets, who are educated in that institution, have done great honour both to themselves and the Doctor, by presenting to him an ornamental piece of plate, value 150 guineas, as a testimonial of their affection and respect. It is an elegant silver vase, with a suitable inscription and appropriate emblems, including the arms of the cadet company as well as the Doctor's arms; the vase, which is 13 inches in diameter, is supported by a cubic pedestal of the most tasteful work. The entire design, which is of a beautifully classical nature, is due, we understand, to one of the senior cadets. The circumstance of this presentation must be the more gratifying to Dr. Gregory on retiring from his long career of official duty, as, during the whole history of the Royal Military Academy, extending over a period of nearly a hundred years, this is the only testimonial of the kind which has ever been presented to a retiring professor. Idem.

Cement for Book-Binding.

Nickels and Collins have taken out a patent, in England, for an elastic cement for combining the leaves of books together, which they pronounce to be cheaper, more expeditious, and better, than India Rubber. G.

They dissolve a pound weight of isinglass, or of the best glue, in three quarts of hot water, and incorporate about a quarter of an ounce of linseed-oil with a quarter of a pound of dry coarse sugar, and when the sugar has taken up all the oil, it is added by degrees to the dissolved isinglass or glue, stirring it until well mixed; the whole is then to be boiled together, until it is of that consistence that it may be laid on when hot, or in a fluid state, with a brush. The book is then to be rounded at the back, either in sheets or in single leaves, and put into a press, leaving the back protruding, and a coat of this cement is to be laid on hot, or rather warm, upon the back, and well rubbed in, that the back-edges may be well saturated therewith. A piece of calico, or any other texture or fabric is to have a coat of the same cement, and to be pressed over it, to confine all the leaves together when dry, which in a warm room will be in a short time; the book is then ready to be boarded and finished off in the usual way. The above is the cement which Messrs. Nickels and Collins state they believe to be the best for the purpose, but variations may be made, provided gelatine is a constituent part, either incorporated with albumen or the mucilage of vegetables. Ibid.

Chrysalis of Silkworms.

A letter from M. Favand, a missionary in China, states, that during his long residence in that country he has often seen the chrysalis of silkworms used as food. He has himself partaken of them, and found them at once strengthening and cooling, and particularly good for delicate persons. After having wound the silk off the cocoons, they are dried in the frying-pan, in order to get rid of the aqueous matter. The envelope will then come off of itself, and they look like little yellow masses resembling the eggs of carp. They are fried in butter, lard, or oil, and moistened with broth, of which, that of chicken gives the best flavor. When they have been boiled in this way for five minutes, they are crushed with a wooden spoon, and well stirred up from the bottom. The Mandarins and rich people add the yolks of eggs, in a proportion of one yolk to 100 chrysalises, and when this is poured over it, it becomes a golden-colored cream, and is of an exquisite flavor. The poorer people are contented with salt, pepper, and vinegar, or, after stripping them, cooking them with oil.

Athenæum.

Fermentation an Act of Vegetation.

M. Turpin has lately published his observations upon certain phenomena which he considers sufficient to show, that the act of fermentation, concerning which chemists have been so much embarrassed, is owing to the rapid developement of infusorial plants. He states, that all yeast, of whatever description, derives its origin from the separation from organic tissue, whether animal or vegetable, of spherical particles of extreme minuteness, which particles, after a certain time, rise to the surface of the fluids in which they are immersed, and there germinate. Their germination is said to be caused by a certain amount of heat, and by contact with atmospheric air. The carbonic acid obtained by fermentation is ascribed to the infusorial plants. M. Turpin considers the act of adding yeast to liquids, when fermentation is languid, as equivalent to sowing millions of seeds in a favorable soil. He calls the yeast plant of beer *Torula cerevisiæ:* he considers each infusion to have its peculiar plant, and he names the whole race of such beings *Levurians.* No doubt the yeast of beer consists of minute molecular matter, the particles of which are globular; and that those particles produce, from their sides, other particles like themselves, which eventually separate from the parent, but we do not know that they are *therefore* plants.

Ibid.

Jones' Machine for Moulding Bricks.

The earth in its descent, is forced into the moulds by great pressure as they pass under the Pug-Mill, and is delivered therefrom in perfect bricks upon pallet-boards ready to be removed, the whole of which is done by the horse attached in the usual mode to the Pug-Mill, producing from 1000 to 2000 bricks per hour. The earth also being moulded with only one-half the usual quantity of water will take considerably less time to dry, consequently there may be nearly double the quantity of bricks made upon the same space of ground. A machine was at work last week on three successive days, at Messrs. Webb's brick-field, near Ball's Pond Church, Islington, and performed the work admirably.

Lond Mech. Mag.

LUNAR OCCULTATIONS FOR PHILADELPHIA, MAY, 1839.					Angles reckoned to the right or westward round the circle, as seen in an inverting telescope. ☞ For direct vision add 180° ☜	
Day.	H'r.	Min.	Star's name.	Mag.	from Moon's North point.	from Moon's Vertex.
5	13	42	Im. χ' Capricorni	5,6	61°	16°
5	14	32	Em.		333	294
11	16	18	Im. ψ Arietis	6	107	58
11	17	7	Em.		305	254
27	9	5	Im. m Scorpii	6	107	77
27	10	6	Em.		203	183

Meteorological Observations for November, 1838.

Moon.	Days	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inch's	Inch's			Inches.	
☺	1	25	40	30.30	30.20	W.S.S E.	Brisk.		Clear—do.
	2	35	55	30	00	W.	Moderate.		Clear—do.
	3	36	61	29.98	29.96	S.	do.		Clear—hazy.
	4	40	56	96	80	S.	do.	1.30	Rain—do.
	5	52	57	60	50	N.	do.	.03	Cloudy—rain.
	6	40	50	70	30.00	W.	Brisk.		Clear—do.
☽	7	34	54	30.20	10	E.S.E.	Moderate.		Lightly cloudy—do. do.
	8	63	66	29.65	29.55	S.	Brisk.	1.04	Rain—cloudy.
	9	36	35	82	90	W.	do.		Cloudy—clear.
	10	24	33	30.50	30.60	W.	Moderate.		Clear—do.
	11	35	39	65	50	S.E.	do.		Partially cloudy—do. do.
	12	30	49	40	36	S.W.	do.		Clear—lightly cloudy.
	13	40	60	10	29.96	S.E.	do.		Lightly cloudy—do.
	14	48	59	00	30.05	W.	do.		Fog—cloudy.
	15	54	63	00	29 95	S.E.	Brisk.	.45	Rain—cloudy.
⊗	16	58	50	29.76	75	S.W.W.	Moderate.		Cloudy—do.
	17	31	39	30.10	30.15	W.	do.		Clear—do.
	18	31	33	05	29.90	N.E.	do.		Cloudy—snow.
	19	25	32	29.90	96	W.	do.	.05	Clear—do.
	20	23	39	30.00	91	W.	do.		Clear—flying clouds.
	21	31	49	05	30.06	W.	do.		Clear—do.
	22	35	52	29.86	29.85	W.	do.		Partially cloudy—clear.
	23	38	54	84	80	S.W.	do.		Cloudy—hazy.
☾	24	34	38	85	90	N.E.W.	do.		Cloudy—partially do.
	25	16	20	30.15	30.10	N.	do.		Cloudy—partially do.
	26	18	30	15	15	N.	Brisk.		Clear—do.
	27	22	38	00	29.87	S.W.	Moderate.		Clear—cloudy.
	28	30	38	29.80	83	W.	do.		Clear—do.
	29	19	39	30.10	30.10	W.	Brisk.		Clear—do.
	30	25	42	10	10	W.	do.		
	Mean	34.27	45.33	30.03	30.00			2.87	

	Thermometer.	Barometer.
Maximum height during the month.	66. on 8th.	30.80 on 11th.
Minimum " " "	16. 25th.	29.50 5th.
Mean	39.80	30.015

JOURNAL

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FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

AND

MECHANICS' REGISTER.

APRIL, 1839.

Physical Science.

Col. Reid's Law of Storms Examined. *By* JAMES P. ESPY.

(Continued from p. 158.)

Hurricane of the middle of Aug., 1837.—St. Augustine, 19th August, 1837. On Tuesday, the 15th August, we were visited by a third gale of wind, of equal severity with the two which preceded it, and which continued until the afternoon of Friday, 18th August, when it ceased.—American paper.

A severe Gale at Turks' Island on the 15th August,—From Lloyd's List Narrative of Mr. Wilkinson, master of the Calypso, in the storm of the middle of August, 1837.

"On the 15th August, noon, the Calypso was, by observation, in lat. 26° 47′ north, and lon. 75° 5′ west; the wind was from the eastward, about *east-north-east;* she had royals and foretopmast studding-sails set: shortly after we got a heavy swell from the north-eastward, and the wind gradually freshened till 9 o'clock, when only the double reefed topsails, reefed foresail, and mizen could be carried. During the night the wind increased, and at 10 next morning, the wind about N. E., the lee rail under water, and the masts bending like canes; got a tarpaulin on the main rigging, and took the maintopsail in; the ship labouring much, obliged main and bilge pumps to be kept constantly going. At 6 P. M. the wind *north-west*, I should think that the lat. would be about 27°, and lon. 77°.

"At midnight, the wind was *west,* when a sea took the quarter boat away. At day dawn, or rather I should have said, the time when the day would have dawned, the wind was *south-west*, and a sea stove the fore scuttle, all attempts to stop this leak were useless, for when the ship pitched, the scuttle was considerably under water. The wind, from about noon of the 16th, till about 10, or noon, of the 17th, blew with nearly the same violence. There was no lull; neither did it fly from one point of the compass to the other;

but backed from *east-north-east* to *south-west*, and then died away gradually.

"On Sunday, the 20th, while beating off Rum Key, the wind was variable and squally. On Monday, in lat. 24° 40′, lon. 74° 45′, we had fine steady winds from the eastward.

The Mary, Sharp, from New Orleans to Barbadoes, was abandoned on the 5th September, lat. 32°, lon. 80°, having been dismasted and thrown on her beam ends, with six feet water in her hold, in a gale on the 16th August, in lat. 27° 30′, lon. 73° 53′.

"The brig Yankee, on the 16th August, in lat. 24° 30′, lon. 70° 30′, experienced a severe gale of wind from the N. E. to S. W., which lasted till the 20th."—N. Y. General Advertiser.

The Rosebud, Dick, from Havana to London, was capsized and dismasted on the 18th August, in lat. 34° lon. 74°.

Wilmington Newspaper, *Aug.* 25.—"On the afternoon of Friday, the 18th, the wind shifted to the *north-east*, and rain began to pour heavily. Before midnight the storm increased, threatening ruin, &c. The tide rose six feet higher than usual."

The Westchester, from Havana, experienced a heavy gale *from the north-east*, on the 18th, and on the 20th, in lat. 32° lon. 74°.

The Maria, from Honduras to London, on the 20th Aug. in lat. 33° lon. 74°, capsized.

Log of Ship Sophia.—On P. M. of 15th, wind E. N. E., steady and moderate, with a heavy lowering; at 4 P. M. in topgallant sails and gaff topsail; at midnight do. weather; A. M. breeze freshening; at noon, strong breeze, with a very stormy appearance, the swell evidently increasing; latitude observed, 31° 37′, lon. per chronometer, 74° 54′ 30″, barometer at fair.

P. M. of 16th. Wind N. E. by E., steady; the sky loaded, to the eastward, with heavy, sluggish clouds, and apparently no distance over head; at 3 P. M. down royal yards; at 6 breeze freshening—at midnight strong gale, with high cross sea, the mercury much agitated and inclined to fall. At 6 A. M. of the 17th, set the foresail again, at noon very hazy round the horizon, with the appearance over head as yesterday; lat. 33° 3′, lon. 75° 9′, barometer fallen to change.

P. M. Wind E. N. E., with the same wild appearance, and every indication of a dangerous change of weather; at 3 P. M. wore ship to southward, barometer still falling, wind E., gale increasing; at daylight of 18th, in fore and maintopsails, &c. At noon heavy gale of wind E. S. E., the sky as if closing around us, and having a most dismal appearance; barometer from stormy to change.

P. M. Heavy gale with violent squalls and rain, wind S. S. E. At 6 P. M. blowing a hurricane—wind S. S. E. Same weather continued till midnight of the 19th. On the morning of the 20th, the wind backed gradually to the northward, with no abatement, and at noon the wind was N. N. W., but not the least abatement—no observation; barometer as yesterday. At 1 P. M. of 20th, wind at N. W. At 6 more violent, if possible. At 8 inclined to moderate, and the barometer to rise. At midnight still dark and gloomy—mercury rising fast. At 10 A. M. of 21st, a fine steady breeze from the westward. At noon, lat. 34° 38′, lon. 74° 20′, having made, since last observation, against wind and sea, 95 miles of northing, and 49 of longitude; barometer at fair.

Narrative of Mr. Macqueen, master of the ship Racolins, from Jamaica to London.

Latitude—Commencement	N.	30°	30′.
Termination		30	40.
Longitude—Commencement	W.	77	40.
Termination		77	18.

Wind commenced on the 16th, at N. E. by E., blowing strong from that quarter about 12 hours, then suddenly veered to N., continuing with unabated vigour till midnight of the 17th; in an instant a perfect calm ensued for one hour, then, quick as thought, the hurricane sprung up with tremendous force from the *southwest*, *not again shifting from that point*. No swell whatever preceded the convulsion. The barometer gave every notice of the coming gale for many hours previous. Two days antecedent, the weather was beautifully serene, but oppressively hot, with light shifting airs; the barometer at that time standing at "set fair;" during the gale so low as almost to be invisible in the tube above the frame work of the instrument. The force subsided at midnight, Aug. 18th, the sea tremendous, and rising in every direction; from the force of the wind no tops to the waves, being dispersed in one sheet of white foam; the decks tenanted by many sea birds in an exhausted state, seeking shelter in the vessel; impossible to discern any thing, even during the day, at fifty yards distance; the wind, representing numberless voices, elevated to the shrillest tone of screaming; but few flashes of lightning, and those in the S. W. On the 19th, wind and sea much abated. A dismal appearance to the N. W.

Narrative of Mr. Turner, master of the ship West Indian, from Jamaica to London.

At noon of the 14th, lat. 28° 28′, lon. 79° 45′, barometer 30.1 inches. At 5 P. M. the weather put on an unsettled appearance, and a strong swell began to set in from the E.N.E., which continued to increase, as did also the wind from the N.E.; the next morning the sky was more settled.

At noon of the 15th, barometer 30.00, lat. 31° 45′, lon. 77° 59′. The heat of the water 8 or 10 degrees warmer than the air, which became equal about midnight. Fresh winds, variable from E.N.E. to N.E., gradually increasing on the morning of the 16th. At noon, no observation, lat., by account, 31° 32′, lon. 77° 13′; barometer 30.00, blowing fresh, wind E.N.E.

At daylight on the 16th, the sky had put on a very threatening aspect; ship's head to the E.S.E., with a tremendous sea from that direction; wind and sea continued to increase all day, with rain; barometer not falling, till 5 P. M., when it went down suddenly 6‴ in. At 3 o'clock, A. M. of 17th, the hurricane commenced, and about noon at its meridian, wind E.N.E. Ship lying to; lat., by account, 31° 8′, lon. 77° 56′, barometer 29° 1′. The wind drawing more easterly. At 6 P. M., wind *east-south-east*, and inclining to the southward; just after midnight it fell nearly calm. At 2 A. M. of 18th, came out in an instant, with all its former violence, from the S. W.

At noon, by account, lat. 31° 21′, lon. 78° 6′, barometer 28° 8′; hurricane still continuing with all its former violence; at midnight it moderated a little, wind veering to the westward all the time. At 4 A. M. of 19th, the wind about W.; got the ship before the wind under close reefed topsails, and scudded before the gale. At noon of 19th, lat., by account, 31° 42′, lon. 77° 14′, barometer 29.30; continued to run before the gale all these 24 hours, the wind getting round to N. W.

At noon on the 20th, lat., by observation, 33° 32′, lon. 72° 13′. In four days ship has been set N. 52° E. 130 miles. For some days after this we had very unsettled weather, with a great deal of sea.

Log of Brig Mary.—On 16th, in lat. 31° 3′, lon. 77° 50′, thermometer, in shade, 82, water 82°, barometer 29.10, having fallen, from the 15th, six tenths of an inch. Wind E.S.E. At noon of 17th, wind E. by N., and N.E. by E. Strong gales and heavy squalls, with a head sea from N.E., barometer 29.00. Thermometer 82°.

On 18th, wind E.S.E.; increasing gales; every appearance of bad weather; bar. falling fast; labouring and straining; bar. 28° 70′. Ther. 80°. Water 82°.

On 19th, wind S.E., gale increasing to a perfect hurricane; barometer 28° 60′. On 20th, wind E.S.E., rising and falling very fast, and unsettled for the last 24 hours; barometer 28° 50′; thermometer, in shade, 74°; water 78°. On 21st, wind from S.E. to N.W.; barometer 28° 10′; a terrific appearance; thermometer, in air, 70°; water 76°; under bare poles; nothing can withstand the wind at present; hurricane continuing to rage more and more; at noon gale abating; barometer rising gradually; I could not leave the deck to note it, but it certainly must have been lower; noon 28° 40′; therm. 70; water 76. P. M., lat. 36° 12′, lon. 72° 11′. On 22d, wind S. W. to N. W.; made all sail that circumstances would permit; heavy rain, thunder and lightning; lat. 36° 22′, lon. 70° 6′; barom. 28.80.

Extract from the Log of the Barque Penelope, J. H. Grimes, Master, from Jamaica to London.—Aug. 18th, P. M. Strong gales E.S.E. and cloudy; at 4 P. M., ship labouring very much, and making a great deal of water; midnight, strong gales; at 3 A. M. of 19th, wore ship to southward, wind E. S. E. At 6 A. M. wore ship to northward; at 10 A. M. hard gales. At noon, lat., by account, 34° 56′, lon. 75° 2′, hard gales N.E. and heavy sea; at 4 P. M. gale increasing; at 8 P. M. tremendous gales. At 2 A. M. of 20th, set main trysail, to keep ship to; in five minutes it blew away in tatters; wind from E. to S.E. At 8 A. M. wind moderated; at 10 more moderate; set close reefed foretopsail; wind E.S.E. to E.; noon, dark cloudy weather; wore ship to southward; noon, lat., by account, 35° 20′, lon. 75° 20′.

In P. M. of 20th, strong gales E S.E. At 4 P. M. wore ship to N. E.

At 9 A. M., (P. M.?) gale increasing, and the wind having veered to N.N.W., came to a resolution of running before it, till the gale abated; at midnight it blew a perfect hurricane from N.N.W.; at 10 A. M. more moderate. At noon, lat. 34° 30′, lon. 72° 20′; at 6 P. M. of 21st, wind hauled to S.W. Made up my mind to gain a port to the northward of Cape Hatteras; latter part of the hurricane from N.N.W.

Extract from the Log of the Barque West Indian, Simpson, Master, from Jamaica to London.—Aug. 20, at noon, lat. 37°, lon. 64°, barometer falling, wind variable these twenty-four hours, from S.W. to E. On 21st, wind variable from S. to S.E., increasing gales and heavy sea from N.E.; at noon hard gales and hazy, barometer down below rain; lat., by account, 38° 23′, lon. 62° 40′. At 6 P. M. hard gales, wind S. At 10 blowing quite a hurricane; we are now involved in a white smoke or fog, and the water as white as a sheet. At midnight nearly calm. At 1 A. M. the wind came away from about W., and if possible blew harder than ever. At 6 A. M. it is blowing a hurricane, and continued till 2 P. M., when it moderated. Lat., by account, 39° 9′, lon. 61° 34′. I have always met with more hurricanes and tempestuous weather in the Gulf Stream than I have found either to the northward or southward, and I cannot account for it.

Extract from the Log of the Ship Ida, Tilley, Master.—Tuesday, Aug. 15. Light breezes E.N.E., and cloudy weather; at noon light breezes and fine; lat. 27° 31′, lon. 79° 36′, ther. 85, barom. 30.10. At midnight wind E.N. E. At noon on 16th, fresh breezes and squally weather; lat. 29° 54′, lon. 79° 39′; ther. 80°; barom. 29.80. P. M. strong breezes; at 3 wind N.N.E. At midnight strong breezes and cloudy, with a swell from the eastward; barom. 29.20. On 17th, fresh gales, increasing till noon, when it blew a hurricane; barom. 29, wind N.E. At midnight blowing a tremendous hurricane, with rain and heavy mountainous sea; barom. 28.50. On 18th, A. M. blowing a most tremendous hurricane, wind veering from N.E. to S.W. within the last twelve hours. At midnight of 18th, found we had run out of the hurricane, but it still blew a heavy gale. On A. M. of 19th, wind W. with strong gales and high sea. On 19th wind W. all day, and also on the 20th. On 21st. S.W. all day, with strong breezes and squally; lat. 32° 7′, lon. 7° 30′, (76° 30′?) On 22d, wind S.W., light breezes and fine weather; at 4 A. M. strong breezes, and squally weather; made a signal of distress to the Citizen, and abandoned the Ida in lat. 33° 14′, lon. 75° 19′.

Extract from the Log of the Ship Westbrook, J. Freeman, Commander, from Jamaica to London.—At 1 P. M. on 15th, light baffling winds; at 7 P. M. increasing wind and looking squally; midnight, wind E.S.E., steady and clear; noon, lat. 32° 20′, lon. 76° 43′; wind variable. At 1 P. M. of 16th, wind N.E.; fresh; clear; at 8 P. M. very heavy appearance in the S., with a good deal of lightning; at 7 A. M. of the 17th, strong gales and a very heavy sea; noon, strong gales and very heavy squalls with rain; lat. 32° 47′, lon. 76° 14′. At 1 P. M. wind E. by N., strong gales and hard squalls; midnight do.; noon of 18th, blowing strong, and no appearance of change; wind E. from 5 A. M. At 1 P. M. wind S. E.; strong gales and a heavy sea. At midnight came on to blow a complete hurricane; noon, no appearance of change. Wind at S.E. until 11 A. M. of 20th, when it veered to N.N.W. Throughout this 24 hours, a terrific hurricane and heavy rain. At 4 A. M. of 21st more moderate, and at noon, lat. 34° 58′, lon. 73° 32′; wind W.N.W.

Extract from Capt. Herbert's Journal of the French Brig Yolof, from Havana to Havre.—Winds variable and weak from the 12th till the 16th, when we were in lat. 32° 14′, lon. 76° 25′ west of Greenwich. Then the wind began to blow from the E.N.E., increasing in force till the 17th, when it became a most frightful tempest, continuing, without intermission till the 18th. On the 18th, from 8 A. M. till noon, great wind and rain. At 8 P. M. calm. Set two sails; but they were hardly set when the wind burst from the W.N.W. like a clap of thunder, and continued frightful all night and next day. On 20th, at 10 A. M., began to clear, and on 21st fine weather, with slight breeze from S.W; On 20th, in lat. 32° 0′.

Narrative of Mr. Griffith, Master of the Ship the Duke of Manchester. At noon on the 15th, light airs and close, oppressive weather. From 4 till midnight, wind variable from N.E. to S. by E. On 16th A. M., light variable winds, and a cloudy, confused sky.

At 8 A. M. a fresh breeze from the N., and hazy weather; a swell from the eastward. Noon, increasing breeze and cloudy; lat. 32° 39′, lon. 77° 30′. P. M., increasing breeze, wind veering from N.E. by E. to E. by N. At 5 fresh gale; at midnight fresh gales and hazy; 17th commences with strong gales and squally, with rain. Day-break, heavy gales and tremendous sea. Noon, blowing a violent gale, with dangerous cross sea; lat. 31° 59′, lon. 77° 2′.

At 1 P. M. blowing a hurricane. A most extraordinary phenomenon

presented itself to *windward*, almost in an instant, resembling a solid, black, perpendicular wall, about 15° or 20° above the horizon, and disappeared almost in a moment; then in the same time made its reappearance, and in five seconds was broken, and spread as far as the eye could see; from this time to midnight blowing a most violent hurricane; much thunder and lightning, the thunder hardly heard, although we were struck with the electric fluid; wind continued E. to E.N.E. till noon of the 18th, with equal violence. In the afternoon it changed to S.W., a little more moderate, but continued violent with heavy gales till midnight of the 20th, wind W. a few hours in the afternoon of 19th, and then S.W. from 6 P. M., and on the 20th W.S.W. all day, and also 21st. On the 19th, lat. 33° 7′, lon. 75° 37′; on the 20th, lat. 33° 47′, lon. 74° 52.

Extract from the Log of the Ship Castries, from St. Lucia to Liverpool, M. Mondel, Commander.—At noon, 24th, lat. 34° 56′, lon. 57° 45′, strong winds E. by S. and cloudy. At 3 P. M. increasing gales. At 6, E. by N., blowing a hard gale with heavy rain. At 10, N. E., and at 11, blowing a hurricane. At 12 N.N.E., and at 2 in the morning of the 25th, wind N., at 4 W.N.W., and at 6 N.W., and so it continued till the 26th, clearing at 10 A. M., with strong breezes. At noon of the 25th, lat. 35° 37′, lon. 57° 42′.

Note.—We had a sudden lull at 4 P. M. of the 24th, whilst reefing topsails.

The Victoria was upset and dismasted on the 24th of August, in lat. 38° lon. 58°.

The barque Clydesdale on the 24th August, encountered a very severe hurricane in lat. 32° 30′, lon. 59° 30′. On the 23d, about noon, came on to blow fresh breezes from E.S.E. At midnight, atmosphere dark and wind S.E. At noon of 24th, blew a complete hurricane, and at midnight gale moderated.

To these logs, which are extracted from Col. Reid, I am enabled to add a few particulars from the newspapers.

From the United States Gazette of 28th Aug., 1837.—Brig Cicero, on 18th, in lat. 32° 20′, lon. 76° 40′, was struck with a hurricane from the N. E. shifting to N.W. and round to S.W. in 24 hours, and was hove on her beam ends.

Same paper of 29th. Severe gales at Washington, N. C., commencing on 18th, and continuing till Sunday evening, 20th. Five or six vessels driven on shore and wrecked.

Same paper of 30th. Delaware on 17th, lat. 31° 30′, lon. 76° 20′, had a severe gale E.S.E., and then W., which continued till 20th.

Same paper of 31st. On the 19th and 20th, barque Penelope, in lat. 33° and 34°, lon. 72°, experienced a severe hurricane.

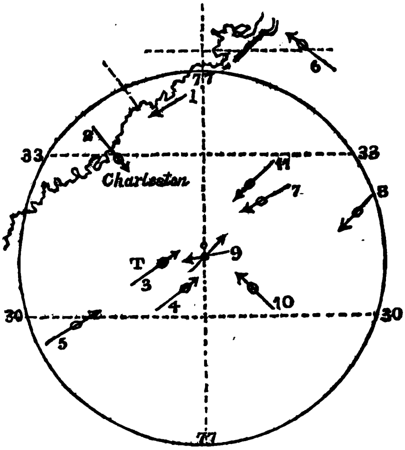
From the National Gazette of 22d. At the Delaware Breakwater on the 20th, the wind N.E. at 7½ P. M., blowing heavy with rain. At 10 A. M. of 21st, wind hauled to N.W.

From Commercial Herald of 28th. The barque King Philip, on 18th, in lat. 31° 12′, lon. 78° 16′; had a gale from N.N.E. to W.N.W.

Same paper of 29th. Brig Oglethorpe, on the 18th of Aug., lat. 32° 29′ lon. 78° 55′, had a violent gale from N. W.

Great rains occurred in the western parts of Pennsylvania, on the 15th, and on the morning of the 16th in the eastern parts. At Alexandria, D. C. wind S. on 18th.

Position of Storm at Noon on the 18th of August, 1837.



Explanation of Engraving.

1. Wind at Wilmington, on P. M. of 18th.
2. Oglethorpe on 18th.
3. West Indian, all 18th, from 2 A. M.
4. Rawlins all 18th, from 2 A. M.
5. Ida, all day of 18th.
6. Penelope on P. M. of 18th.
7. Yolof till 8 P. M. of 18th.
8. Westchester on 18th.
9. Duke of Manchester till P. M. 18th.
10. Delaware on 17th, and probably on 18th, changing round to westward on 20th.
11. Cicero on 18th.

I have culled out of this storm that portion of time in which I find the greatest number of simultaneous observations, and I have exhibited on the annexed wood cut the localities of all the ships within the boundaries of the storm, whose latitudes and longitudes could be ascertained with any degree of certainty, with arrows, exhibiting the course of the wind. The time is noon of the 18th of August, 1837. At this time the Duke of Manchester was only a few miles N.E. of the centre of this storm, for some time in the afternoon the centre of the storm passed nearly over her, when the wind changed pretty suddenly S. W. At this time, and for some seven or eight hours both before and after, all those ships which were labouring in the most violent part of the storm, had the wind blowing towards a central space of no great magnitude. This settles the question of a violent centripetal motion of the wind in this storm, in conformity with the five previously examined, and also with the twelve investigated by the Joint Committee of the American Philosophical Society and Franklin Institute, and with not less than fourteen land spouts which have already been examined, in all of which the trees were thrown with their tops inwards—and when any are thrown across each other, those which are underneath are uniformly found to be thrown inwards and backwards, and these on the top to be thrown inwards and forwards, just as they should be, if the wind blows inwards. Whereas, if the wind is centrifugal, many of the trees should have the tops thrown outwards on both sides of the path. Let the reader cast his eye on the chart, and he will perceive, in the borders of the storm, some anomalies worth his particular attention. If I have really discovered a true law of nature in these storms, these apparent anomalies will be found to confirm the law in a wonderful manner. Just as the moon's anomalies, when understood, were found to harmonize, in a most beautiful manner, with the law of gravitation. The anomalous arrows in this storm are the Penelope and Wilmington on the N., which seem to favour the idea of a rotation of the air from right to left, and the Westchester on the east, which seems to indicate a rotation from left to right. This is in conformity with phenomena accompanying storms previously investigated by the Committee, (see second Report, and also September No. of the Journal of the Franklin Institute,) and it is in exact conformity with what ought to take

place, if the wind does blow inwards towards the centre of the storm; as will appear from the following considerations. When the air rises in the centre of the storm, and expands by the evolution of the caloric of elasticity given out in the formation of cloud, upwards of six thousand cubic feet for every cubic foot of water generated in the cloud, as explained before, it must spread out in an annulus all round the borders of the storm, and cause the barometer to rise, in that annulus, above the mean, just as it did in this storm to the Rawlins, the Sophia, and West Indian, (Turner) as the storm was approaching their vessels, and as it is now known to do in all our great N.E. storms that come from the S.W. If a storm should spring up in our neighbourhood, that is, commence in our vicinity, and not come upon us from a distance, such a rise of the barometer could not take place. Now this rise above the mean will evidently take place in front of the storm, because the upper current of air is moving in that direction, and of course the great body of the upmoving column of air in the middle parts of the storm will be pressed by the upper current in that direction. And it is manifest, that beyond the annulus where the barometer stands above the mean, the air will blow outwards from the storm, and within the annulus it will blow inwards. But as in front of the storm there is one point of the annulus where the barometer stands higher than in any other, the wind will tend in all directions from that point, and of course it will cause the wind, in the very borders of the storm, to appear to rotate both ways.

As the air must necessarily come downwards in the annulus where the barometer stands above the mean, "set fair," for instance, as it did with the Rawlins, we would expect the weather to be without a cloud, and very hot, as it was. Indeed it would be easy to show, that if the air in the annulus were to come down from a height of four miles, it would be about 45° hotter than it was when it left the surface of the sea in the centre of the storm to go up, for it would bring down with it the caloric of elasticity evolved, as it went up, by the condensing vapour, and the quantity evolved in going up a given height is known if the dew-point is given. But the full explanation of this subject is reserved for another occasion.

The centre of the storm at the moment I have chosen, the noon of the 18th, was between 31° and 32° N. lat., and was at that time moving about N.E., for the centre passed over the Rawlins, and very near to the Yolof, about 150 miles to the N.E. of the Rawlins. In this part of its course, it traveled only about 8 miles an hour; for it passed over the Rawlins at half after 12 in the morning of the 18th, and did not reach the Yolof till 8 P. M. of the same day.

If this storm was round on the 18th, of which we have no proof to the contrary, there is strong reason to believe it did not long continue round. For on the 21st, it reached from the Westbrook to the West Indian, (Simpson) about 700 miles; so that unless it widened out in like proportion in the other direction, its N.E. and S.W. diameter became greater than that from N.W. to S.E. If this was really the case, as it was in the storm of 1821, and if it moved towards the east, then all the phenomena would be easily explained, and the storm of the Wanstead and the storm of the Clydesdale, Victoria, and Castries would be one and the same storm.

This can be ascertained hereafter; for in this case it is probable that Bermuda experienced something of it on the 22d and 23d. If this meets the eye of any person acquainted with the fact, either one way or the other, let him communicate it to the world. New facts connected with any of the storms here investigated would possess a very high degree of interest.

It appears from the logs of the Clydesdale and the Castries, that the storm passed over them about the same time, though the latter ship was near 200 miles to the N.E. of the former. Now this can only be accounted for on supposition that the centre of the storm is not a *point*, but a *line*, lying in the direction of N.E. and S.W., and moving side foremost, or obliquely. There is another circumstance which favours this idea, namely, the storm lasted a much shorter time with all the vessels on the 21st, 22d, 23d, and 24th, than on the 18th, though the storm was much greater in diameter on these days from N.E. to S.W. than it had been before, even with those ships near which the centre passed,—for instance, the Columbus and the Delos. But it is useless to conjecture. The data are not yet sufficient to demonstrate whether there were two storms or one. I will merely add, that if the line joining the Clydesdale and the Castries should be prolonged, it would pass a little E. of the place where the Wanstead experienced a severe gale on the day before, lat. 43° 34′, lon. 54° 20′, which also favours the idea that these two storms were one and the same, with a long diameter from N.E. to S.W.

Raleigh's Typhoon of the 5th and 6th of August, 1835, *in the China Sea.*—As Mr. Redfield, of New York, has given a more full account of this storm than Col. Reid, I extract the following details from him.

"*H. M. Brig Raleigh*, Aug. 1, 1835.—Working out of Macao Roads.—At noon, east end of Grand Ladrone, E. ½ S.—Aug. 2d, at noon, S.E. end of Formosa N. 85 E. 340 miles: fine weather all day.—Aug. 3d, at noon, S. end of Formosa N. 82½ E. 252 miles. Fine weather all day.—Aug. 4th, 10h. 20m. A.M. close reefed topsails and courses:—12h. 30m. P. M.—barometer fell from noon $\frac{15}{100}$; took in mainsail and foresail;—at 1h. 30m. got all snug; vessel going through the water between 3 and 4 knots; barometer 29.40, falling;—at 7h. 30m. wind veered to N.N.E. and typhoon commenced; at 8 P. M. barometer 29.36, falling;—8h. 30m. typhoon increasing;—10 P. M., close reefed fore trysail and set it;—typhoon veering to E.N.E. with a heavy sea;—at midnight typhoon increasing; barom. 29.04, falling.

"Aug. 5th.—3 A.M. typhoon veering round to E.S.E., still increasing in violence;—6h. 30m, barom. 28.25;—8 A.M. typhoon increasing;—9h. 30m. A.M., if possible blowing heavier, *ship went over;*—in this awful situation the ship lay for about 20 minutes;—9h. 50m. lower masts went by the board and ship righted with 7 feet water in her hold; barometer did not fall lower;—at noon typhoon moderated a little;—at 6 P.M. typhoon more moderate, with a heavy sea;—midnight, strong gusts of wind with heavy sea from S."

Abridged from Canton Register of March 14, 1837.

At *Macao*, where the typhoon was experienced on the 5th and 6th, many houses were damaged; also many lives were lost in the inner harbour, and some vessels were driven on shore. The direction and changes of the wind at Macao are not stated; but we are favoured with the following valuable table of the state of the barometer during the period of the storm.

"August 5th:

h. m.	Barom.
1 00 a. m.	29.47
2 30 p. m.	29.28
5 00 "	29.20
7 20 "	29.12
9 00 "	29.08
10 20 "	28.95
10 45 "	28.90
11 05 "	28.85
11 30 "	28.75
11 53 "	28.65
August 6th.	
0 15 a. m.	28.50
0 30 "	28.40
0 45 a. m.	28.30
1 20 " (*lowest*)	28.05
1 25 "	28.08
1 45 "	28.20
1 55 "	28.30
2 00 "	28.37
2 25 "	28.56
2 45 "	28.68
3 10 "	28.75
3 40 "	28.83
4 10 "	28.90
4 45 "	28.97
5 15 "	29.02
6 00 "	29.08
6 45 a. m.	29.12
7 45 "	29.20
8 15 "	29.21
8 45 "	29.23
9 30 "	29.27
10 25 "	29.30
11 00 "	29.34
2 00 p. m.	29.42

and continued rising to 29.65, at which point it usually stands during fine weather."—*Canton Register, Aug.* 15.

This table affords, in itself, good evidence of the passage of the centre of the vortex near to Macao.

At *Canton*, (60 miles N. of Macao,) the typhoon began on the evening of the 5th, after three or four days of very hot weather, with northerly winds, and continued throughout the night and the next day. Its violence was greatest about two o'clock on the morning of the 6th. The following is an account of the state of the barometer and winds at Canton:

		August 4th.		
9 a. m.	barom.	29.79	Wind N.W.	Fine weather.
4 p. m.	"	29.70	" N. by W.	Moderate breeze.
		August 5th.		
9 a. m.	"	29.62	Wind N. and N.W.	Fair weather.
4 p. m.	"	29.54	" unsettled—Rain and fresh breeze.	
12 p. m.	"	29.37	" N. blowing hard and in heavy gusts.	
		August 6th.		
5 a. m.	"	29.34	Wind N.E. blowing hard with heavy rain.	
9 a. m.	"	29.51	" S.E. do.	do.
11 a. m.	"	29.58	" S E. blowing hard—moderating.	
5 p. m.	"	29.70	" S.E.	do.
11 p. m.	"	29.85	" S.E.	do.
		August 7th.		
8 a. m.	"	29.94	Wind S.E.	Cloudy.

Compiled from the Canton Register.

On Wednesday, the 5th inst. a tyfoon swept over the city of Canton. It began in the evening and continued throughout the night and the next day, blowing its best about 2 o'clock in the morning. The damage done by the typhoon at Canton is small, but not so at Kumsingmoon, Macao, and elsewhere on the coast.—*Canton Paper.*

Extract from a private letter from on board the ship Lady Hayes, which left Macao Roads a day or two before the storm, and returned to Kumsingmoon, after the gale.

"Early on the morning of the 5th, we observed indications of bad weather. At 10 A. M. the wind freshened a little from the same quarter it had been for the last 24 hours, viz. *north;* so we thought it best to turn her head back again to look for shelter, fancying ourselves to be about 35 miles off

the land. We carried a press of sail until noon, when we found we had too great a distance to run before we could get into shelter, and expecting it would get so thick that we could not see our way; so we turned her head to sea, and clapped on as much sail as she could stagger under, *steering S. E. by E.* The wind being then at N., we were desirous of getting as far off the land as possible, expecting the wind round to the eastward, there being a most *tremendous swell* from that quarter. *At* 4 *P. M.* it was blowing in severe gusts, and we shipping a good deal of water, and the ship becoming unmanageable. About 8h. 30m. *the wind began to veer to the west*, but continued to blow as hard as ever, till midnight, when it *drew round to south*, and moderated a little. It continued to blow hard from that quarter until noon of the 6th, when it moderated fast, and we began bending other sails in room of those that were split. When the gale commenced, which we consider it did *at* 1 *P. M. on the 5th*, we were about 20 miles E. of the Lema; where we were when it ended it is hard to say, as we saw nothing till the morning of the 7th, when we made Mondego Island. We hardly think we could have had the gale so heavy as those inside; and what is most extraordinary, the wind with them *veered to the eastward round to south*; but with us it veered to the *westward* round to south. It was fortunate for us that it veered to the westward; for had it veered to eastward, we should most likely have been driven on shore among the islands, as we could not have been more than 50 miles off the land, at 8 P. M. on the 6th.—*Abridged from the Canton Register of August* 18*th*.

Log of the American Ship Levant, Capt. Dumaresq.

Courses.	Winds.	
N. N. E. Distance by log, 171 miles.	S. W. Breeze $6\frac{1}{2}$ to 8 knots.	August 4th, 1835. [Nautical time.] Throughout these 24 hours fine breezes and clear, pleasant weather. All possible sail set. Current N.E. by N. 50 miles. Lat. by obs. 12° 55′ N. Lon. by chr. 112° 13′ E.
N. b. E. $\frac{1}{2}$ E. N. b. E. Distance by log, 190 miles.	S. W. Breeze 7 to $8\frac{1}{2}$ knots.	Aug. 5th. Commences with fine breezes, and pleasant. All sail set and trimmed to the best possible advantage. Middle and latter part the same. Lat. by indifferent obs. 15° 55′ N. Lon. " " 113° 24′ E.
N. $\frac{1}{4}$ W. Distance. by log, 225 miles.	S. S. W. Breeze $8\frac{1}{2}$ to 10 knots.	Aug. 6th. Begins with fresh breezes, and cloudy. All sail set. At 4 P. M. passed a barque standing eastward. Through the night strong breezes and squally, with rain and heavy sea. Latter part the same. Took in the royal studding sails. [The ship was now running into the path of the gale which had just passed.] At 11 A. M. [6th] heavy squalls, with rain in torrents. Took in all studding sails, royals, and top-gallant-sails, and double reefed the topsails. No observation: sun obscured. Lat. by account 19° 54′ N. Lon. " 113° 38′ W.

Courses.	Wind.	
N. ½ W. North. N. ¼ W. North. N. b. E. to N. W. and to N. E.	South to S. S. E. S. b. W. to S. E.	August 7th. From noon to 8 P. M., strong breezes and squally. Shook out reefs and set all light sails. Middle part, fine breezes and pleasant weather. At daylight made the Ass's Ears bearing E. by N., distant five miles. At 7 passed the Great Ladrone. After part, wind S. E. and pleasant.

Now, if the reader will take a map of the China Sea, and choose any particular moment, from 4 P. of the 4th till midnight of the 5th, and draw arrows representing the course of the wind through Canton and the respective localities of the Raleigh and the Levant, he will find they will nearly meet, if prolonged in a central space of no great magnitude, where the storm must have been at that time, if it traveled regularly from the time of passing the Raleigh, at 3 A. M. of the 5th, till it passed Macao, a little after midnight on the morning of the 6th, and at the moment when the barometer stood lowest at Macao, the wind was N. at Canton, and S. with the Levant, both blowing exactly towards Macao.

Again, it is worthy of remark, that the wind had been N. for several days at Canton, and immediately on the setting in of the typhoon, the wind became occasionally N.W., whereas, on the whirlwind theory, it ought to have turned more N.E. The same may be said of the wind with the Levant; on the passage of the typhoon, the wind changed round to S.E. as the storm passed away to the N.W. When the storm passed Canton, the wind changed round to the S.E., and continued blowing exactly towards the centre all the 6th, that is, on supposition this storm moved in the same direction as the West India storms in this latitude, as it is known they curve rapidly on reaching this latitude towards the N.W. and N. As to the Lady Hayes, it is impossible to tell where she was, as her log leaves that undecided; but if she was near Macao at about 3 P.M. of the 5th, then from that to midnight, an arrow drawn in her locality would, for that time and for some time afterwards, point inwards towards the same space with the other arrows.

Mr. Redfield says, in the pamphlet before me, that "he considers the depression of the barometer in these tempests, as due to the rotative action, and the point of greatest depression, as indicating the true centre or axis of storm."

But this cannot be the case, for I have shown in one of my essays in the Journal of the Franklin Institute for 1836, that it would require an outward motion of the air from the centre of 240 ft. per second to make the barometer fall an inch, and of course a corresponding motion downwards in the centre of the storm. And Mr. Redfield says he "has but little objection to my formula on this point, subject to such corrections for countervailing tendencies as the case requires." See Journ. Frank. Inst. for Feb. 1837. Now, as the wind tended inwards in this storm, the cause here alleged for the fall of the barometer is not the true one.

But Mr. Redfield has proposed a means of testing my theory in the following paragraph:

"*Test of Mr. Espy's Theory.*—The truth or error of Mr. Espy's theory may be ascertained by a very simple test. The hurricanes in the West Indies are known to move towards the W N W. nearly. Now, if this

theory be true, at those islands which are in the centre of the storm's path, and where the gale is of the greatest duration, the wind will set in at about W.N.W., or exactly opposite to the course of the storm, and when its centre has passed over, will shift suddenly to E.S.E., and continue violent in this quarter till the storm is over. But if the gale be a whirlwind, as the facts seem to show, the wind at such places will set in at about N.N.E., and in the middle of the gale will shift nearly to S.S.W.—the wind varying from these points, and veering more gradually on either side, in proportion to the distance from the centre of the storm's track. That this corresponds, mainly, to the facts of the case, will hardly be doubted by those who institute the inquiry. The same test may also be applied to these storms, as they move in a N.E. direction along the shores of the United States; where, according to Mr. Espy's views, the gale, on the centre of its path, should blow, for the first part of its duration, from about N. E.; and in the second half from nearly S.W. But all our inquiries serve to show that the gale is violent at N.E. only on the northern portion of the track of the tempest, and that the usual changes from this direction are not sudden, and to an opposite point of the compass; but instead thereof, we observe a gradual veering by the N. to the N.W."

I accept this test with the corrections which I am sure Mr. Redfield will allow, namely, on Mr. Redfield's theory if the wind sets in N.E., in storms on our coast, it never can change round to N.W., not even gradually, as he acknowledges it does. Second, this test can only apply to round storms, and if any shall be found with their N.E. and S.W. diameter much longer than their N.W. and S.E., then if such a storm moves towards the eastern quarter, the wind, on my theory, ought to set in from S.E., and change suddenly round to N.W. as a general rule.

It being always understood that allowance is to be made for oblique forces produced by various causes, but especially by an annulus or semi-annulus of increased barometric pressure to the N. or N.E. of the storm in its onward motion. Let us then put the theory to the torture.

Numerous examples were given in the storm of 1821, before investigated, all harmonizing with the test here proposed by Mr. Redfield, to which the reader is referred in the last No. of this Journal. Nor is the present storm of 1837 wanting in remarkable examples. The Ida changed round from N. E. to S.W. in twelve hours, having begun at N.N.E. and continued to blow, all day of the 18th, S.W., exactly towards the Rawlins and the Yolof, during which time the centre of the storm passed near both those ships. The Rawlins, also, which remained nearly stationary during the storm, as appears by her log, had the wind to set in N.E. by E., and changing round to N., after a calm of one hour, sprung up quick as thought from the *south-west*, and it did not change again from that point. The Duke of Manchester also had the wind to change round from N.E. by E. through the E. to S. W., from which point it blew with violence till the afternoon of 19th.

The Yolof is a slight exception, but the phenomena with her will not agree so nearly with the centrifugal theory as it will with mine. The wind changed round with her from the E.N.E. to W.N W.; how long it continued there is not mentioned. The direction of the wind is not mentioned from 8 P. M. of 18th, when it changed, till the 21st, when it was only a slight breeze from S.W. These are the only vessels having the centre of the storm passing near them. Let the candid reader judge how they satisfy the conditions required by the "test."

I will now give all the evidence on this point which I have at my com-

mand, of hurricanes, both in the West Indies and in the Bay of Bengal. It was mentioned before, that Edwards, in his History of Jamaica, vol. 3d, says that "all hurricanes begin from the N., veer back to the W.N.W., W., and S.S.W., and when got round to S.E., the foul weather breaks up." And he also says, in the same volume, "when the wind is S. and S.W. on the S. side of the island, it is often north-easterly on the N. side, attended with heavy rains." As Mr. Edwards lived on the S. side of the island, it may well be asked if the winds on the N. side of the island in time of hurricanes do not change round from N. by E. with as much constancy as he says they do on his side round by W.? Also, Col. Copper, speaking of the great hurricane which occurred on the Coromandel coast, on the 29th Oct., 1768, page 60, says: "the wind began from the N.W., *as is usual at the commencement of these hurricanes.*" And Col. Reid says this same hurricane terminated S.E. (page 264.) And on next page he says, of another quoting from Col. Copper, that it began in the N.W., and suddenly shifted to the eastward.

In the great Barbadoes hurricane, of 1831, August the 10th and 11th, as given by the author of the West Indian, the wind began N., varying from N.N.E. to N.N.W., during the first half of the storm, but strongest from the N.W. and N.N.W., and terminated from the S.E., though once it reached round for a few minutes near the end of the gale to E., and soon got back to S.E., increasing to a hurricane, but unaccompanied with those fatal gusts which, from the western quarter, had effected so much destruction—the hurricane terminated two hours and a quarter after this, with strong breezes from the E.S.E., and an hour after that, the dense body of cloud began to break up. (p. 38.)

Luke Howard, in his second vol., gives an account of a hurricane at St. Lucia on the 21st Oct. 1818. "The wind is stated to have set in N.W. at daybreak, and raged with tremendous violence, with occasional falls of rain, until 3 P. M.; when becoming southerly, it abated, but did not immediately cease."

It would appear, from the following account, that in latitudes as high as 25°, the storm sets in N.E. and terminates S.W. Mr. Howard, in his 1st volume, speaking of the Nassau hurricane of the 26th July, 1813, says, "At about half past 2 P. M. the hurricane attained its greatest height, and its acme continued, without interval, until five, when *it suddenly ceased, and in the space of half an hour succeeded a calm*, so perfect that it can be compared only to that of death after the most dreadful convulsions. The inhabitants of the colony, well knowing the nature of hurricanes, took every precautionary measure within their reach, during the calm, or lull, to prepare for the second part expected from the S.W., and which set in with great fury at about six o'clock, and continued until midnight, when it considerably abated, and soon after totally ceased. The first part of the storm from the N.E., raged without intermission, but the latter part appeared in heavy blasts of a few minutes' duration.

If the reader will refer back to the investigation of the great Barbadoes hurricane of 1780, he will find evidence of the most decisive character on this point. By examining all the accounts of the beginning of the storm at Barbadoes, he will discover, that though the wind began to blow from the N.E. with some violence, from the oblique force produced by the trade winds, which in this region are known to blow all the year, yet it backed round to N.W., and blew for many hours with its greatest violence, and then changed back again by the E. to the S.E., beyond which it did not go.

Now, as the centre of the storm certainly passed within a few miles of the western side of this island, as shown before, for it passed between Barbadoes and the Albemarle, which left Barbadoes during the storm, the facts furnished here are even more conclusive than if it had been merely stated that the wind commenced N.W. and terminated S.E.

It is hardly necessary to remark, that as this storm, after passing Barbadoes, traveled nearly N.W., and not W.N.W., the conditions required by the "test" are fully answered.

In concluding the examination of this storm, I earnestly recommend to gentlemen who embrace the whirlwind theory of storms, to abstain from laying down rules to the practical navigator, founded on this doctrine, until it is better established than it is at present. And especially I recommend this course to Mr. Redfield, lest the practical evils arising from unfounded rules may diminish the lustre which his great discovery of the *translation of storms in space, and their continuity in time*, is beginning to shed round his name.

Philadelphia, April 6th, 1839.

(TO BE CONTINUED.)

Mechanics' Register.

LIST OF AMERICAN PATENTS WHICH ISSUED IN MAY, 1838,

With Remarks and Exemplifications by the Editor.

177. For an improvement in the *Force and Suction Pump;* Andrew Bailey, Jefferson, Ashtabula county, Ohio, May 4.

The claim under this patent is to "the construction of the valve boxes, in combination with a double pump barrel, constructed substantially as described;" which description it would be an entire waste of time and space to give at any length to the reader, as the, so-called, improvement consists in a mere change in the form of the parts, which change does not appear to us likely to render the action of the instrument better than that of pumps previously constructed; on the contrary, we think it will be found inferior to the greater number. A single cylinder is to be employed, and this is to be made to operate as two cylinders by a partition dividing it into two semi-cylinders, each to be furnished with a semi-circular piston, which is a bad form; to each of these semi-cylinders there are to be two lateral valve boxes, after passing through which the water is to be forced up vertical tubes, the pistons being worked by a double crank; an arrangement by which the direction of the water will be changed as frequently and as abruptly as could be desired by any one who wished to sacrifice power.

178. For an improvement in the mode of *Applying Springs to Clocks;* Joseph S. Ives, city of New York, May 4.

Instead of placing the main springs of spring clocks within the frame, and between the plates, in the usual manner, there is to be a box, or cap, attached to the outside of the front plate, the cavity within which is to contain the spring, that is to operate on an arbor in the usual way. The claim is to the so placing of the spring; and the patentee states that "by

this method, springs can be applied to any common clock, made to run with weights, without making any alteration in them, or taking them in pieces."

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179. For an improvement in the *Speeder for Roving Cotton;* William Mason, Taunton, Bristol county, Massachusetts, May 4.

The claims made are to "the manner of connecting the ground spindle with the pulley and with its hub, and with the flyers, so that it can be drawn out for doffing, as described; and also to the construction and employment of centrifugal levers, made and operating in the way above described." We cannot offer an adequate description of the things claimed, without the drawing; the mode of admitting of the withdrawing of the spindle for doffing is ingenious, and manifestly good. The centrifugal levers are small pieces of metal attached by joint pins to a flanch on the end of a hoop which constitutes a part of the open end of the flyer, or cap. These levers are curved, and are heaviest at their outer ends; the thread passes through a hole in their inner, or smaller, ends, as it proceeds from the tube which carries it through the flyers. By their weight, at their outer ends, these levers expand by the centrifugal force, with a power proportioned to their velocity, causing their inner ends to press upon the spools, and laying the yarn hard and compact upon them; and, consequently, admitting of a very high degree of speed.

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180. For an improvement in *Carriage Springs;* Elbridge G. Woodside, Augusta, Maine, May 4.

These springs are to be scroll, or volute, springs, like those used for clocks, but made sufficiently strong for the purpose intended. They are to be attached in any convenient way, so that they may act as carriage springs. The patentee says: "Although such scroll or volute springs are well known, and have been long used for various purposes, they have not heretofore been used in the manner described, for the purpose to which I have applied them, namely, that of carriage springs; I therefore claim as my invention, and ask an exclusive right to, the adaptation and application of such springs to carriages, substantially in the manner set forth."

It is believed that such springs have been applied as carriage springs, long since, but the evidence of this fact must have been before the office to justify it in the refusal of a patent. This, it is believed, was the principle upon which the grant was made; it being the practice of the office to give all the benefit of a doubt to the applicant, leaving him finally to sustain his claim, if he has a valid one, in a court of law.

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181. For an improved method of *Packing and Storing Ice;* Frederick Tudor, Boston, Massachusetts, May 4.

(See Specification.)

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182. For a *Machine for Manufacturing Shot;* Alfred Duval, city of Baltimore, May 8.

This machine is for casting shot, from lead; the patent is taken principally for the manner in which the respective parts are arranged for the convenient performance of the operation; the moulds are fixed around the periphery of a circular revolving table, above which is the furnace and cru-

cible for melting the lead, which passes down through a tube to the mould. The claims are as follows:

"1st. Moulding shot by means of a horizontal revolving wheel of moulds, which receive the melted lead directly from the crucible, and discharge the shot, when moulded, by dropping the under section of the moulds as they pass from the end of the way. 2d. The double handed tube and receiver for conveying the lead to the moulds, and the construction of the receiver for shearing off the superfluous lead from the top of the moulds, and conveying it over the centre partition of said receiver to the forward part of the same. 3d. The combination of the hanging frame rollers and hammers for keeping the moulds from springing upwards, and for discharging the moulds by the action of the tappet hammers upon the mould plates. 4th. The arrangement of the reservoir, tubes, and trough, for cooling the moulds, as described. 5th. The perforated elevators, and column of water passing through them for cooling the shot. 6th. The arrangement of the cylinder for polishing the shot. 7th, The construction and arrangement of the frustum of cones for compressing and rounding the shot."

The cylinder for polishing the shot is to revolve with the shot within it, accompanied by some black lead; what there is special in this arrangement we are not informed. "The frustum of cones" consists of a conical nut revolving like the old coffee mill nut, within a hollow cone, the nut having a semi-cylindrical groove around it, descending spirally, and the shot being fed into this, and passing down the semi-cylindrical spirals, are to be rounded thereby.

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183. For a machine for *Hulling Clover Seed;* Daniel Hunsicker, Hartley township, Union county, Pennsylvania, May 8.

This machine is constructed very much like some which have preceded it, and which have not answered very well in practice. The seed is to be hulled by being rubbed between a cylinder and a concave adapted to it; the improvement consisting in the manner of forming these, being to "the making the cylinder of teeth out of separate cast iron rings, and also the making the concave of separate segments, as described."

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184. For a machine for *Thrashing Clover;* Samuel Keen, Strasburg, Shenandoah county, Virginia, May 8.

This patent is taken for adapting a cylinder thrashing machine to the thrashing, or hulling, of clover; as this arrangement does not give it a character differing much from that of other clover hullers, we shall merely state the claim, which is "to the arrangement of the sheet iron concave for the purpose of adapting the machine to the purpose of hulling clover seed."

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185. For an improvement in the geared *Drill Stock;* George Page, Keene, Cheshire county, New Hampshire, (now of Baltimore) May 8.

Drill stocks, worked by a wheel and pinion, are well known, and the addition made to this instrument by the patentee consists in placing a friction roller under the large wheel, on the side opposite to the gearing, so as to sustain it near its periphery, instead of allowing it to bear on its gudgeons only. The claim is to the manner of combining the friction wheel with the working gear of the drill stock.

186. For an improvement in the *Cotton Compresser;* Henry Waterman, Bath, Lincoln county, Maine, May 10.

This *cotton compresser* appears to be a press for pressing cotton, the power being applied to it through the intermedium of a toggle joint, and the bale to be pressed is to be acted upon both above and below at the same time, the bed piece of the press being raised as the follower is depressed. The bed piece, or lower follower, is connected by rods to a cross head on the upper ends of the upper levers of the toggle joint, and the upper, or ordinary, follower, is connected to the lower ends of the lower levers of the toggle joint. When the toggle joint is bent, these followers will consequently recede from each other, and will approach when it is straightened, which straightening is to be effected by means of a shackle bar on a crank shaft, turned by a wheel and pinion. The whole pressing of a bale of cotton, or of a bundle of hay, must, under this arrangement, be effected by a single straightening of the toggle joint; and if this can be done, the said joint must have a pretty long sweep, as the unpressed cotton occupies a very large space. The claim is to "the before described mode of giving the follower a simultaneous movement upward whilst the piston moves downwards, thus pressing the substance placed between them on the bottom as well as on the top."

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187. For a machine for *Skiving or Whitening Leather*; Seth Graham, Roxbury, Massachusetts, May 10.

This machine is necessarily described at considerable length, with numerous references to the drawing. The patentee says that he is "not aware that the knives used in the operation of skiving and whitening leather have ever before been operated by machinery; the mode heretofore practised being by manual labour; my general claim, therefore, has been to the arrangement and combination of the whole of the above machinery that gives motion to the knives," &c. It would be useless to give these claims, as they would not, without the machine, or drawings of it, afford any idea of the particular construction in question. We will remark, however, that so far as a judgment can be formed from the materials before us, the machine appears to be well calculated to fulfil its intention.

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189. For a machine for *Hulling Clover Seed*; Jacob Flook, Middletown, Frederick county, Maryland, May 10.

A square box is to be furnished with three, or more, floors, on horizontal partitions covered on each of their faces with graters of perforated sheet iron. Through each of these floors there is an opening to allow the seed and hulls to pass down from one to the other, A vertical shaft passes up through the centre of the box, and is made to revolve by suitable means; this shaft carries arms which occupy the spaces between the floors, and which are, like the floors, covered with graters of sheet iron. The upper part of the box forms a hopper in which to put the clover to be hulled. The box is divided into halves by a cross section down its middle, allowing it to be separated for access to the interior. The claim is to "the combination and arrangement of the roughened floors and arms for hulling clover seed, in the manner described; also to the constructing the machine in two parts."

190. For an improvement in *Locks for Doors, Chests, &c.*; Robert Wilson, Burdett, Tompkins county, New York, May 10.

The claim made in this lock is to "the combination and arrangement of the safety spring, spring guards, and studs, or points, in the manner described." The safety spring is riveted to the plate of the lock at one of its ends, the other end springing up, and bearing against a projection on the bolt, and preventing it from being moved until the key, by its particular construction, and the manner of using it, is made to depress the said spring. The particular arrangement could not readily be described in words; but we do not think that this will be any special source of loss, as the contrivance is one of that character which may be made by any person of very moderate mechanical skill, and of a kind which a skilful workman could invent, with variations, every day of his life.

191. For a *Churn*; Rufus Porter, Billerica, Middlesex county, Massachusetts, May 10.

The external form of this churn is that of a square box; its bottom is concave to adapt it to the dashers which are to be made to revolve within it by means of a winch. There are two openings in the lid for ventilation. The mode of fixing the winch into the dasher shaft, and also the particular manner of constructing all the parts, are described with much minuteness and clearness; but, after all, there seems but little to distinguish the apparatus from numerous other churns of the same general character. The claims are to "the mode of ventilation and the method of adjusting the crank to the dasher by a twisted tenon." It will be seen, therefore, that the patentee himself does not discover much of novelty in his apparatus.

192. For an improved *Pencil Case;* Thomas Addison, city of New York, May 10.

In this pencil case, the pencil is to be protruded by means of a spiral groove and a pin working in it, in a manner which, as is stated in the specification, was invented and introduced several years since, but which was abandoned because there was not any adequate provision for preventing the shoving back of the pencil when in use. The object of the present improvement is to remove this defect, and the claim is to the "making a spiral channel or screw in the inner or outer tube in combination with a seat in the lower end of either to receive the stop of the pencil tube, to prevent the pencil or pen shoving back whilst writing."

193. For an improved mode of making *Table Knives and Forks;* George Ropes, Portland, Maine, May 10.

The claim under this patent shows the nature of the whole invention, which "consists in making the blades and start of the common table knife, except the bolster, in a single piece by cutting from sheet steel, instead of making the start in a separate piece and welding it on to the steel blade, as heretofore done; and for fastening the bolster on to the table knife or table fork, in either or all of the methods described; and also for making the bolster of the table knife or fork by either of the methods described. I also claim the making the handles of table knives and forks of any suitable metal by casting them on, either in connexion with, or separate from, the bolster, as above described."

The modes referred to of "affixing to the knife, and also to the common

table fork that projection commonly called the bolster, is by casting, riveting, or soldering, it on to the start of the knife or fork after the blades and starts are made as above described," &c.

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194. For a *Mill for Grinding Grain;* Perry Davis, North Providence, Rhode Island, May 17.

This is an addition to the numerous family of portable grist mills, the improvement in which is said to consist in "the manner of hanging and adjusting the upper stone, or bed, and for raising and lowering the lower stone, or runner;" and the claims are to "the raising and lowering the spindle vertically, without producing infringements, by means of the arrangement of the rollers in the bridge tree, as described. The method of hanging the bed stones by means of sliding blocks and screws, as described. The method of hanging the runner to the spindle so as to raise and lower it by means of the bushing and screws."

It seems that the office considered that there was novelty enough in the things claimed to render it proper to grant a patent; but as we do not perceive in them any thing which is a substantial improvement in this kind of mill, it would be loss of time to particularize the peculiar devices claimed. There are inherent defects in the small portable grist mill, which of course cannot be removed; but, barring these, we believe that it has already been made as useful and convenient as the nature of the case admits.

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195. For a *Thrashing Machine;* Linus Yale, Samuel W. Stimson, and Nathaniel Stimson, Little Falls, Herkimer county, New York, May 17.

The claim under this patent consists in the "placing the spikes in a narrow circle on the face or edge of the large wheel, in combination with the hopper, as described."

A large wheel is to be driven horizontally, and is to have on its face, near its periphery, rows of spikes projecting upwards; and on a part of the frame, above these spikes, there are to be others projecting downwards. The grain is to be fed on to the wheel from a hopper. The arrangement is novel, but, until convinced by actual experiment, we shall not be prepared to believe that this machine will operate as well as many others previously used.

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196. For an improvement in the *Loom for Weaving Satinett, Kerseymere, and other Cloths;* John D. Seagrave, Uxbridge, Worcester county, Massachusetts, May 17.

"The nature of my invention consists in attaching to what is commonly called the top roller, or top harness roller, of satinett, and all other looms using more than two harnesses, an apparatus that will make a plain selvage of any width desired while the body of the cloth will be waled, or kersied. The claim is to "the combination of the separate selvage harness with the top roller, as described."

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197. For an improved process for *Gilding Copper, Brass, &c.;* Geo. Elkington, kingdom of Great Britain, May 17.

(See Specification.)

198. For an improved *Corn Eradicator;* Peregrine Williamson, city of New York, May 17.

This is an instrument for removing corns from the feet, which operates upon the well known principle that if they be not subjected to pressure in any degree they will disappear. A small plate of metal is to be made concavo-convex, for the purpose of covering the corn, the concavity being such as to receive it, without touching it. The edges of this plate are perforated, so as to admit of its being attached to a strip of cloth, by which it may be fastened round the toe, or foot. The claim is to "the forming a metallic plate so that it shall be concavo-convex; and applying the plate so formed to the eradication of corns in the manner set forth."

We have removed corns by an analogous contrivance, namely, by sewing together several thicknesses of woolen cloth, and punching a hole through the pad thus made. This is to be confined in place so that the corn shall enter the hole; the relief is immediate, and the cure certain.

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199. For an improvement in the *Plough;* Henry Taylor, Montague, Franklin county, Massachusetts, May 17.

The claim made is to "the peculiar mode of attaching the coulter and share, and extending the share up so high as to receive the bolt which unites the coulter, share, mould board, and chip." This is of the number of those minor improvements which may be dismissed without animadversion.

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200. For an improvement in the mode of *Cutting off the Steam in Steam Engines;* Isaac Adams, Boston, Massachusetts, May 17.

The nature and object of the invention are thus described by the patentee:—

"My said invention consists of an addition to each end of the common slide valve in such manner as to form apertures through which the steam must pass in entering the cylinder; these apertures agree in dimensions with the induction apertures in the valve seat, (this valve I shall call the slide valve) and furnishing the outer surface of the slide valve with a sliding plate, or plain slide valve, which I shall call the cut off valve; the two valves are operated by two eccentrics, the one which operates the cut off valve being placed on the shaft with its most eccentric part in advance in the direction of its motion of the most eccentric point of the eccentric which operates the slide valve, so that the cut off valve is always brought to either extreme of its motion before the slide valve, and consequently returns in season to cover the aperture through the opposite end of the slide valve, and thus to cut off the communication between the steam chest and the interior of the cylinder at a half stroke, more or less, this circumstance being governed by the relative position of the two eccentrics in their orbit of rotation.

"The communication between the steam chest and the interior of the cylinder being thus cut off, the steam already in the cylinder will exert its expansive force upon the piston until it has reached one extreme of its motion, when the steam is allowed to escape from the cylinder as usual; and so on alternately.

"I claim the combination with steam engines of the slide valve having apertures constructed and operating as above described; and also the combination of the cut off valve with the slide valve, as above described and set forth. The purpose of the apparatus claimed being the working of steam expansively and in a more complete and advantageous way than has been

heretofore practised. I also claim the mode above described of giving the proper motion to the valves, viz. placing the cut off eccentric in advance of the slide valve eccentric, as above described."

201. For an improvement in the *Truss for Hernia;* Samuel A. Brown, Petersburg, Virginia, May 25.

"The improvement consists in making the metallic strap which goes round the body, in three parts, united by two hinged joints at the sides; and a strap and buckle behind. In the centre of the middle piece is made an oblong mortise in which moves a slide to which the pad plate is attached.

"The invention claimed and desired to be secured by letters patent, consists in making the bands in three parts, hinged together, having in the centre of the middle piece an oblong mortise in which a slide or slides move, to which the pad plate or plates are attached, for adjusting the same to the ruptured parts, as before described." The two hinges mentioned are placed so as to come below each hip of the patient.

202. For an improvement in the process of *Colouring Hats, Furs, &c.;* Harmon Hibberd, Attica, Genessee county, New York, May 25.

The process described in the specification of this patent is altogether empirical, as will appear to any one having a moderate acquaintance with chemistry. A mordant is to be prepared by putting into a large earthen pot, one quart of nitric acid, a quart of vinegar, three copper cents, and scraps of sheet tin sufficient to saturate the acids. When this is effected, another quart of vinegar is to be added, and the liquid is then to be bottled off for use. For each hat to be dyed, about a gill of this liquid is allowed, and a proportionate quantity for cloth or yarn. It is to be put into the dye kettle with a sufficient quantity of water for the number of hats to be dyed; these being put in, are to be boiled for about half an hour, with the addition of about six ounces of logwood for each hat, and a like quantity of sumack; these latter are to be boiled in a separate kettle until the extract is completed; the hats are then to be removed from the dye kettles, and the extract poured into it; one pound of pearlash is then to be added for every thirty gallons of the dye; the hats are then to be boiled for two hours in the liquid, when, it is said, they will commonly have a good black gloss.

To colour furs on the felt, the alkali is omitted in the dye, and they are prepared, after being tanned in sumach liquor, by brushing on the fur side a preparation made by boiling one pound of quicklime, and four ounces of red lead in one gallon of water, until half boiled away. This is to remain on an hour, and is then to be washed off; before the fur is dry, it is again to have the mordant brushed over it, and subsequently the dye, boiled down to double the strength above stated, is also to be brushed over it.

After certain observations which we shall not copy, the patentee claims "the using a fixed alkali in the composition of a dye, in the manner above described; likewise the mixing of nitric and acetic acids, and dissolving metals in the manner and proportions above described, to be used as a mordant, as set forth."

203. For an improvement in *Fire Arms;* William Jenks, Columbia, South Carolina, May 26.

This is a gun which is to be loaded at the breech, by an arrangement of

the parts which appears to be convenient and simple; since obtaining the patent, the patentee has, however, made a new and much more perfect arrangement for effecting the same object, and has obtained a patent therefor; this we shall, in due course, present with the specification in full. The present claim is to "the combination of the slide, plug, and stop, as set forth."

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204. For an improvement in *Wheel Carriages and Harness;* Geo. Barnard, District of Columbia, May 25.

The patentee says that "a leading object and property of the invention is to facilitate the running of a carriage by attaching the wheels with a degree of mobility so that the shocks and irregular motions in passing over an uneven surface may not be directly received, but may be shared by the rest of the carriage. For this purpose, instead of the common stiff axletree, I make a separate axle to each wheel, bent down between the wheel and carriage, in the form of a crank, the two turns being right angles, or nearly such, making the direction of the arms, or parts on each side of the crank wrist, quite, or nearly, parallel. The inner and lower of these arms is fastened as a pivot under the carriage, thereby letting the arm which is the axis of the wheel swing, or rock back, to a certain extent, when the wheel is borne against a prominence, or impeded by any obstacle in its course."

The foregoing is one of the main features of the proposed improvement, but it will be seen, by the annexed claims, that several others are presented in his specification. This claim will furnish a pretty clear idea of the nature of most of them, and will probably contain as much on these points as most of our readers will desire. The arrangements manifest considerable ingenuity, but we apprehend their chance of general adoption is but small. Several of them have been anticipated to a considerable extent; still there is sufficient originality in the mode of effecting the object desired to justify the grant of a patent. The cranked axles, for example, are not new, axles perfectly similar in their action having been made in Albany, N. Y., about twenty-five years ago, at the suggestion of the late H. G. Spafford; and the late Stephen Van Rensselaer (the patroon) owned and rode in a carriage so constructed; the only difference between it and those now under consideration being that one cranked axle received the two wheels in the former, whilst the present patentee has a separate axle to each wheel.

The following are the claims:

"What I claim as of my invention, and wish to secure by letters patent, is comprised in the following nine articles, reference being had to the foregoing specification for particular descriptions.

1st. A separate crank shaped axle to each wheel of a carriage, with the lower arm thereof attached under the carriage, so as to roll, or turn, like a pivot, thereby making the upper arm, or axis, of the wheel movable, to a certain extent, in a sweep backward or forward.

2d. The method of affixing to the carriage a separate axle to each wheel, by the outward bearing sliding through an aperture, and the inward end being suspended from above, so as to let the axle slide, more or less, out from, or in under, the carriage, but not to let the part confined under the body move or twist backward or forward; thereby providing for the occasional running of either wheel, nearer to, or farther from, the carriage.

3d. The manner of hanging, or suspending, the body of a carriage herein

set forth, whereby it is allowed to move, or swing, forwards from its station whenever the wheels are resisted.

4th. The manner of suspending the body of a carriage by links, or straps, each pair of which are set nearer together at their upper than at their lower points of attachment, thereby holding the body in a position more nearly level than a right line between the stations on the ground of the two wheels, whenever one wheel of the pair is running on higher ground than the other.

5th. A carriage wheel, which may be elastic to any required extent, made with a spring steel rim, from the inner surface of which, at stations corresponding with the insertion of spokes into the rim of the common wheel, connexion is made to each end of the pipe which is to run upon the axis, by means of rods, or wires, of iron, or other metal, or straps, or cords, whereby the axis is always supported by suspension from the upper part of the wheel.

6th. The confining a spoke in the hub by a metal ring, the inside of which bears against a shoulder, cut for the purpose, on every spoke of the wheel.

7th. A leg for a hand cart, hung before its upper end, so that it may swing and glide over any obstacle struck by the foot when the cart is in motion, and having the upper end fitted to enter a cavity made for the purpose in the frame work of the body, directly over the leg, so that the whole may stand firm when the body is let down upon the leg, provision being made for the leg to run up into the cavity, by the axis of suspension being allowed room to glide downward, as far as may be required.

8th. Draught irons, such as hereinbefore described, applicable to the harness for carriages which have a part of their burden resting on the horse's back; that is, two wheel carriages. These draught irons are applied at the side of the horse, where the shafts are supported by the back bearing, and allow free action to the horse's shoulders by the draught strap, or chain, from the collar being attached to an iron, which, at each forward movement of the shoulder on that side, acts as a lever in slightly raising the shaft, or virtually shortening the back bearing.

9th. The application to harness for two wheel carriages of a steel, or iron, bar over the horse's back, resting on, or running through, the pad, or saddle, in place of the back band, or chain, commonly employed.

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205. For improvements in machinery for *Raising and Carrying Ships;* Hiram S. Meeker, and James Bergen, Jersey City, state of New Jersey, May 25.

The patentees say that "the nature of their invention consists in the construction of two vessels, which they call *carriers*, built of such shape that they will adapt themselves to the sides of a ship; that is, concave on the side applied to the ship to be lifted, and convex on the opposite sides. Each carrier is built sharp at its two ends, and partly in the form of a crescent, so that when not in use at ships' sides, or when about to be towed to the place where they are to be used, they may be joined together and be secured with heavy iron clasps." These carriers are furnished with chains passing through tubes leading down from their decks through their bottoms, and provided with windlasses by which they can be hove taught when passed under the vessel to be raised. When used for raising a sunken vessel, the

carriers are to be allowed to be filled with water, and sunk, so as to attach them to the vessel, when the water is to be pumped out from them.

"The invention claimed consists in the before described construction of the ship carriers in sections of the above form, so that they can be united by clasps in such a manner as to present the appearance of a double pointed boat, which can be towed, floated, or propelled with the machinery required to the place where said carriers are to be used, and then separated, and arranged on the sides of the ship or body to be raised, the chains passing under the same, and made fast to the windlasses on the carriers. Also the combination and arrangement of the pumps, valves, air tubes, windlasses, chains, and rollers, in the manner, and for the purposes set forth.

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206. For an improvement in *Refrigerators;* Henry V. Hill, District of Columbia, May 25.

(See Specification.)

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207. For a mode of *Fastening Hoe Handles*; George Hight, Gorham, Cumberland county, Maine, May 25.

The claim is to "the riveting the hoe plate to the shank plate, and securing the shank in the handle by means of a wedge and pin; or by a screw, in combination, as described." Modes of fastening hoe handles closely resembling that which is made the subject of this patent, have been long in use, but the case seems to have been one of those in which the identity of the modes was considered as a thing of doubt, and therefore the patent was granted.

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208. For an improvement in the *Mortising Machine*; John Andrews, Sudbury, Massachusetts, May 30.

We may remark of this, as we have repeatedly done of mortising machines, that the patent is granted for certain particular matters of arrangement not affecting the general construction of the machine. After the number of patents which have issued for such machines, it seems indeed almost impossible to discover a new species, and we look only for varieties of the old. In the present case the claims are to a "mode of setting the chisel for various depths, and the scale in combination therewith, as described, and also the index for setting the chisel at any angle, as described."

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209. For a *Churn*; Enoch Thomas, Harrisonburg, Rockingham county, Virginia, May 30.

The claims under this patent seem to have been put in for the mere purpose of making a claim, the general construction of the churn affording little or no foundation upon which one could rest. The box, or body of the churn, is to be placed upon rockers, and within it there are to be dashers, or divisions, formed of slats, for the agitation of the cream; in the lid there is to be a hole or opening left for ventilation; and we are told, contingently, that "wire gauze may be put over the opening to keep out flies," and the claim consists "of the wire gauze covering," and nothing more. The transition of this from a patented to an unpatented churn, and *vice versa*, may be, therefore, very quickly and conveniently made, nothing further being

necessary than to remove or replace a piece of wire gauze, which *may*, or may not be used.

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210. For a machine for *Mowing Grass, Grain, &c.*; Ira Wheeler, Salem, Rockingham county, New Hampshire, May 30.

The main feature of this machine consists of a cart (without a body) drawn forward by animal power, and to which, on one side, is suspended a frame containing a horizontal vertical wheel fixed on a revolving vertical axle, around which, at the bottom, are a number of horizontal scythes for cutting the hay, &c.; which, as fast as it is cut, "is carried round by fingers and deposited on a revolving endless apron in the rear of the same, which conveys it off at the end of the frame and lays it in win-rows, or, if grain, it is deposited by said apron into a box with a sliding bottom, by which it is dropped in gavels; said frame being raised and lowered so as to be adapted for the kind of cutting required, by pins inserted through posts of the frame into the shaft."

The wheel above spoken of is in the form of a reel, having two heads, and vertical rounds, or slats, extending from one to the other; on these rounds, or slats, the fingers are fixed, while the scythes are on the lower head. The claim is as follows:

"The invention claimed, and desired to be secured by letters patent, consists in the before described construction of the wheel for cutting grass, grain, and other articles, and depositing the same upon a revolving apron, which lays it in win-rows, or gavels; in combination with the inclined boards and fingers, box with sliding bottom, and levers and spring for drawing it out and in, as herein set forth. And it is to be understood that the parts separately are not claimed, but only in combination; and in the wheel, the heads and vertical axle are not claimed at all."

Most of the mowing machines which have been made have disappointed the hopes of their projectors, the operation being one of no small difficulty; we are well convinced that the one before us will not steer clear of the objections which have been found to exist in others that have had their brief day, and then expired.

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211. For improvements in *Saw Mill Dogs*; Hezekiah Thurber, Painted Post, Steuben county, New York, May 30.

The record of these improvements occupies nineteen pages, and we shall not attempt to give an epitome of the specification, nor shall we copy the claim, as this would not throw any light on the particular arrangements which form the ground work of the patent.

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212. For an improved *Windlass*; Russell Evarts, Madison, N. Haven county, Connecticut, May 30.

This windlass does not differ materially from others now in use, but there is some novelty in the manner of arranging and connecting certain parts by which the gearing is operated upon so as to increase, or otherwise regulate, the power applied; the claims are to these special arrangements.

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213. For an improved *Furnace for Smelting of Lead*; Robert A. Drummond, and G. W. Fuller, Galena, Jo-Daviess county, Illinois, May 30.

The smelting furnace which is the subject of this patent differs but little,

except in the proportioning of its parts, from the furnace ordinarily used in England for the same purpose; but the patentees aver that by the changes which they have made there is a substantial difference in the effect produced; and although a mere change of proportions is not a patentable improvement, yet when a new result is obtained by it, such a change becomes a legitimate subject for a patent. There is, however, as will appear by the claim, a provision for constructing the hearth so as to keep it at a comparatively low temperature, for the purpose of cooling the unsmelted part of the ore, and to prevent its running down with the lead; the latter remaining in a fluid form at a temperature lower than that which will solidify the fused ore, and, consequently, detain it on the hearth.

Claim.—"What we claim as our invention, and wish to secure by letters patent, is not the mere reduction in the general dimensions of the furnace when compared with what is known as the English furnace, but to such a mode of constructing and proportioning the respective parts, as above described, as promotes the separation of the lead from the mineralizers with greater facility and economy than have been hitherto attained; a result which is principally dependent upon the acceleration of the current of heated air in contact with the ore in the furnace. We also claim the manner of constructing the hearth of the furnace, as above described, by which we are enabled to keep it at a comparatively low temperature, which not only renders it very durable, but prevents the formation of slag, and causes also the grain, or unseparated particles of ore, to become chilled, preventing the running down thereof, whilst the reduced lead being in a perfectly fluid state, escapes readily; a result not obtained in the English furnace."

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214. For an improved mode of *Applying Friction to the Yarn Beam of the Power Loom;* Stephen Kimball, Pultney, Windham county, Vermont, May 30.

A friction belt, or belts, made of iron or steel, is applied to the cloth beam, and made to bear thereon with a force which is graduated by a regulating screw; and the claim made is "to the steel or iron spring constructed as described, in combination with the elliptic spring and warp beam, in the manner set forth."

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215. For an improved *Reacting Water Wheel*; Nelson Johnson, Erwin Centre, Steuben county, New York, May 30.

In this, as in most of the recent reacting water wheels, dependence for a new and great result is placed upon some trifling variation of shape; it is, in most cases, difficult to define these variations in words, and when this can be done, it is usually a loss of time to do it. In the present instance, we dismiss the thing with the claim to "the manner in which the buckets are constructed; that is to say, their descending curve from the top to the bottom of the wheel, and having their peripheries, or the outer rim of the wheel, cut away to allow of the free escape of the water, laterally."

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216. For *Facing Iron with Steel, for Sleigh Runners,* and tire for Wheels; William Johnson, Newark, New Castle county, Delaware, May 30.

The claim is to "the application of steel to the outer surfaces of the shoe,

or tire, by whatever process it is manufactured;" and we can scarcely conceive a more doubtful claim, as there certainly is neither invention or discovery, but the mere application of iron and steel, united by well known modes, to a purpose in which its application requires no special skill, or particular adaptation.

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217. For a *Circulating Sugar Boiler*; Francis Hoard, Boston, Massachusetts, May 30.

This patentee is now, it appears, a resident of Demerara, British Guiana, at which place, we suppose, he has his boiler in use; his American patent, however, can be available for the United States only.

This boiler, or series of boilers, have a metallic flue running under, and metallic tubes passing through them; the whole structure being of metal. The claims do not give much idea of the nature of the things claimed; they are to "the application of the within described flue, to the purpose of making sugar from suitable juices; the general modification of the entire apparatus to the purpose of making sugar, and the mode of charging forward the liquor, and taking off the sugar."

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218. For an improved *Boiler for Steam Engines*; Levin P. Clark, city of Baltimore, May 30.

"My steam boiler consists of a number of cylinders within which the water is to be contained; which cylinders I have arranged and connected together by tubes passing from one cylinder to another, in a manner which I believe to be substantially new." There are two rows of cylindrical boilers, one above the other, the fire being under the lower row, and the draft returning between it and the upper row. The steam chamber is formed by tubes rising vertically from the upper row of boilers, and by a horizontal tube into which they all enter; and the upper and lower row of boilers are also connected by tubes passing from one to the other. Each of the cylinders is supplied by a separate supply pipe. There is but little novelty in the whole affair, and the patentee is aware of this fact, but considers his particular arrangement as affording some substantial advantages, and claims "the combination and arrangement of these parts, taken as a whole, when made and constructed with the boilers arranged and connected with the steam tube, with the supply pipe, and with each other, specifically and substantially as set forth."

The foregoing claim, it will be seen, confines the patentee within the limits of his own construction, specifically; and it is believed that the case was one requiring this strict limitation, and that the office would not have been justified in issuing a patent under a claim more broad and general.

Specifications of American Patents.

Specification of a patent for an improved mode of Packing and Storing Ice. Granted to Frederick Tudor, *Boston, Massachusetts, May* 4, 1838.

Be it known, that I, Frederick Tudor, of Boston, in the county of Suffolk, and state of Massachusetts, have invented a new and improved mode of packing or storing ice, so as to diminish the wasting or decaying thereof:

and I do hereby declare that the following is a full and accurate description.

The nature of my invention consists in packing, or storing, in the following manner, by means of any non-conducting material which will fill the interstices of the blocks of ice, as is hereinafter mentioned, and exclude the atmosphere, to wit: The floor, or bottom, of the place where ice is to be stored, having been properly prepared, and the ice having been cut into blocks of convenient size, one layer of blocks is placed upon said floor, or bottom, and the interstices between said blocks are to be carefully filled with any nonconducting material, and a layer of said nonconducting material spread over the whole; a second layer of blocks is then to be put on the former layer, and all the interstices filled as before, and a layer of said nonconducting materials spread over the second layer, and so on until the required quantity is stored.

Various nonconducting materials may be employed for the purpose, such as sawdust, pulverized cork, rice chaff, or any other which may be preferred, and which may be adapted to the filling of the interstices between the separate blocks and layers of ice. The bottom and sides of the receptacle may be prepared in any of the ordinary modes of so doing; my improvement consisting entirely in the filling of the spaces usually left between the separate blocks of ice, with any suitable nonconductor, it having been found that by so doing, the ice is preserved from melting for a much longer period than usual.

What I claim as my invention, and wish to secure by letters patent, is the application of any nonconducting material as aforesaid, in the manner above stated, to the packing or storing of ice, thereby destroying or relieving the altitudinal pressure of vapours generated by the ice, and preventing the wasting, melting, and decaying of the same.

FREDERICK TUDOR.

Remarks by the Editor.—It will be admitted by all those who are acquainted with the career of the patentee, that he must be one of the best practical judges in the world of the most advantageous modes of stowing and transporting ice, as he has been the great transporter of icebergs to the torrid regions. It cannot be doubted that by excluding the air, or preventing the interchange of its particles among the blocks of ice, it will be more effectually preserved than without such precaution; but had the theory of its action been omitted in the specification, it would have been equally valid, and we should have been spared the attempt to guess what are the vapours generated by ice, whose *altitudinal pressure* affects it with consumption.

Specification of a patent for an improved method of Gilding Copper, Brass, &c. Granted to GEORGE R. ELKINGTON, *of Birmingham, Great Britain, May* 17, 1838.

To all whom it may concern: Be it known, that I, George Richards Elkington, a subject of the queen of Great Britain, and now at Birmingham, in the county of Warwick, in the said kingdom of Great Britain, have invented or discovered a new and "an improved method of gilding copper, brass, and other metals, or alloys of metal," and I, the said George Rich-

ards Elkington, do hereby declare the nature of my invention, and the manner in which the same is to be performed, are fully described and ascertained in and by the following statement thereof, (that is to say:) my invention consists in gilding copper, brass, and other metals, or alloys of metals, by means of potash, or soda, combined with carbonic acid, and with a solution of gold, as hereinafter described. And in order to my invention being most fully understood, I will proceed to describe the process as performed by me, and which has fully answered the purpose, the articles operated on having a very beautiful appearance, and in most instances are considered to be gilded far better than when similar articles have been submitted to the gilding process where quicksilver is used. The process of gilding by the aid of quicksilver being well known, and in general practice, and as it forms no part of my improved method, but is entirely different from my invention, no description of such process will be necessary in this my specification.

I will first describe the preparation of the materials, and then explain the process of using the same. Dissolve five ounces, troy weight, of fine gold, in 52 ounces, avoirdupois weight, of nitro-muriatic acid of the following proportions, videlicit, twenty-one ounces of nitric acid, pur. of 1.45 specific gravity—seventeen ounces of muriatic acid, pur. of 1.15 specific gravity, and fourteen ounces of distilled water. For this purpose, the gold being put into the mixture of acids and water they are to be heated in a glass, or other convenient vessel, till the gold is dissolved. And I usually continue the application of heat after this is effected, and until a reddish, or yellowish, vapour ceases to rise.

The clear liquid is to be carefully poured off from any sediment which generally appears, and results from a small portion of silver which is generally found in alloy with the gold. The clear liquid is to be placed in a suitable vessel, and I prefer the same to be of stone pottery ware. Add to the solution of gold, four gallons of distilled water and twenty pounds of bicarbonate of potash of the best quality; let the whole boil moderately for two hours. The mixture will then be ready for use. The liquid being thus prepared, and as in practice it is difficult to keep the liquid hot in stoneware vessels when many articles are being dipped, I have found it advantageous to transfer the liquid to a cast iron vessel, which it is necessary to keep very clean. The articles to be gilded having been first perfectly cleaned from scale, or grease, they are to be suspended on wires conveniently for a workman to dip them in the liquid, which is kept boiling.

The time required for gilding any particular article will depend on circumstances, partly on the quantity of the gold remaining in the liquid, and partly on the size and weight of the article; but a little practice will readily produce sufficient judgment to the workman. Supposing the articles desired to be gilded to be brass, or copper, buttons, or small articles for gilt toys, or ornaments of dress, such as earrings, or bracelets, a considerable number of which may be strung on a hoop, or bended piece of copper, or brass, wire, and dipped into the vessel containing the boiling liquid, above described, and moved therein, and the requisite gilding will be generally obtained in from a few seconds to a minute; this is when the liquid is in the condition above described, and depending on the quality of the gilding desired, but if the liquid has been used some time, the quantity of gold will be lessened, which will vary the time of operating to produce a given effect, or the colour required, all which will be quickly observed by the workman, and by observing the appearance of the articles from time to time, he will

know when the desired object is obtained; though it is desirable to avoid taking the articles out of the liquid as much as possible. When the operation is completed, the workman perfectly washes the articles so gilded with clean water—they may then be submitted to the usual process of colouring. If the articles be cast figures of animals, or otherwise of considerable weight, compared with the articles above mentioned, the time required to perform the process will be greater.

In case it is desired to procure what is called a dead appearance, it may be performed by several processes; the one I usually employ is to dead the articles in the process of cleaning, as practised by brass founders, and other trades, and it is produced by an acid prepared for that purpose, and sold by the makers, under the term deading aquafortis, which is well understood. It may also be produced by a weak solution of nitrate of mercury applied to the articles previous to the gilding process, as is practiced in the process of gilding with mercury, previous to spreading the amalgam, but generally a much weaker solution. Or the articles, having been gilded, may be dipped in a solution of nitrate of mercury, and submitted to heat to expel the same, as is practiced in the usual process of gilding. It is desirable to remark that much of the beauty of the result depends on the well cleaning of the articles, and it is better to clean them by the ordinary processes, and at once pass them to the liquid to be gilded. I have always employed the usual means for cleaning the articles from scales and other impurities, which are commonly resorted to in working of the metals for other purposes where the surfaces are required to be freed from scales, or other impurities, and I would remark that great care should be observed in purchasing the articles above described of the best description. I have described only the using of bicarbonate of potash, which I believe to be the best material for the purpose, and I would remark that soda, in a state of carbonate may be employed, as also some other preparations of potash and soda, but, so far as my experience goes, not with such advantages as potash in a state of bicarbonate, as above described.

Having now described the nature of my invention, and the manner of performing the same, I would have it understood, that, although in order to give the best information in my power, I have stated exact quantities of the articles employed, I do not confine myself thereto, nor do I claim any process for cleaning, or deading; but what I claim as the improved process of gilding, is the gilding copper, brass, and other metals, or alloys of metals, by means of potash, or soda, in the state of carbonate, or otherwise, and a solution of gold, as above described.

George Richards Elkington.

Specification of a patent for improved Refrigerators for the preservation of articles of food. Granted to Henry V. Hill, *District of Columbia, May* 25, 1838.

To all whom it may concern: Be it known, that I, Henry V. Hill, of the city of Washington, in the District of Columbia, have invented an improvement in the refrigerators employed for the preservation of articles of food; by means of which improvement the metallic lining generally used is dispensed with, whilst the timber is rendered more durable, and the instru-

ment more effectually preserved from any offensive odour: and I do hereby declare that the following is a full and exact description thereof.

I construct a double box, or chest, in the usual way, interposing between the two pulverized charcoal, or any other bad conductor of heat, as has heretofore been done; but instead of lining the inner box, or chest, with zinc, or other metal, I saturate the wood with a resinous composition, which I cause the pores of the wood to imbibe by means of heat; the composition which I general use, and the means by which I apply it, are as follows:

I combine together about two parts of rosin and one part of beeswax, and by means of iron made as hot as can be admitted without actually burning the materials, I spread this resinous matter over the inside of the box, continuing the operation until I have forced as much of it into the pores of the wood as they will imbibe, and also leaving a thin coating thereof upon the surface. This preparation will effectually protect the wood from the action of water, and consequently from decay. I sometimes, especially when the refrigerator is to be kept in a damp place, coat the outside thereof with a similar resinous material, in the same way. The composition may also, if preferred, be applied to the exterior and interior of the boxes, or cases, constituting the refrigerator.

What I claim as my improvement in refrigerators, is the saturating and coating the wood of which they are constructed, with a composition of rosin and beeswax, or with any other resinous compound, similar in its properties, in the manner, and for the purpose, herein set forth.

HENRY V. HILL.

English Patents.

Specification of a patent granted to CHARLES WATT, *and* THOMAS RAINFORTH TUBBETT, *of Manchester, in the county of Lancaster, for their invention of certain improvements in the manufacture of the oxides of lead, and also of the carbonate of lead.* Sealed January 5, 1838.

I would first remark, that as carbonic acid does not combine with metallic lead when these bodies are placed in contact with each other, it is necessary that the lead should be converted into a protoxide, and subsequently into a carbonate; and as this fact is well known to all practical chemists, I shall proceed to describe our improvements in the manufacture of the oxides of lead, and also of the carbonate of lead, which consist of three different improved processes for obtaining the white hydrate of protoxide of lead, and converting the same into carbonate of lead; and I shall, therefore, describe these processes separately, and the manner of effecting the objects of our improvements.

Firstly, the metallic lead is to be converted into a protoxide or litharge, in the usual way of manufacturing the said oxide; in which state it may be purchased as an article of commerce, or manufactured as required; or we produce a hydrate of protoxide in the following manner:

We boil the protoxide, or litharge, with either of the chlorides of sodium, potassium, or barium, in a state of solution, in a suitable iron, or wooden,

vessel, heated by steam pipes, or other convenient manner, until the chlorine in these substances has passed into the oxide of lead, which is thereby converted into chloride of lead, which becomes perfectly white, when the process is properly conducted and perfected.

Having now obtained the chloride of lead, we proceed to produce the hydrate of protoxide from the same, by expelling the chlorine by means of sulphuric or nitric acid, thereby converting the chloride of lead into a protoxide of lead combined with either of these acids, which we effect in the following manner:

We take the chloride of lead, prepared as above stated, and red oxide, (usually called red lead,) in the proportions of three-fourths of the former to one of the latter: these are placed in a suitable vessel, or retort, and to them is to be added concentrated sulphuric acid, in weight equal to about one-third of the whole chloride and red oxide; and we then apply a gentle heat thereto, by means of steam, or in any other convenient manner; which heat is to be continued until all the chlorine is expelled, and the red oxide converted into a white sulphate. The vessel in which this operation is to be performed may be of cast iron, with an earthenware head, so constructed that the chlorine thus formed may pass into an apparatus, such as is usually employed in making the chlorides of lime, soda, &c.; such apparatus being varied according as the chlorides are intended to be made or formed in a dry or liquid state. We then remove the sulphate which has thus been produced into a wooden vessel, or tub, furnished with a cover, and well wash it with pure water, in order to remove therefrom any uncombined sulphuric acid, letting the waste water run off until that remaining with the sulphate is free from acid; we then add by degrees, and at intervals of about ten minutes, a solution of some alkaline or earthy carbonate, choosing such of the latter as are soluble in sulphuric acid, more particularly alumine and magnesia. While adding the solution of alkaline or earthy carbonate, we frequently or continually stir the mixture, continuing the process of pouring in the solution so long as any effervescence continues. The sulphate of lead has now become a white hydrate, containing much carbonate; and in order to ensure the perfect conversion of the whole into carbonate, we cause a current of carbonic acid to pass into the precipitate or mixture, and continue it for about an hour, keeping the vessel in which the operation is performed nearly closed, or covered with slight pressure on the lid, in order to obstruct the escape of the gas, the whole being occasionally agitated, or stirred, by any suitable means: the usual Woulfe's apparatus is best calculated for this operation, and may be made of wood, or earthenware. We generate carbonic acid gas in the usual way adopted for such purposes, which is too well known to require particular description. We then again wash the precipitate, or what may now be called white lead, several times with clear water, in order to remove therefrom the salts which have been formed by the chemical action: the process is now completed, and the white lead fit for use.

In our second process, we proceed as follows:—We take chloride of lead, and place it in an earthenware vessel, or such other material as is not acted upon by nitric acid, and which is furnished with suitable conducting off pipes and receiving vessels: the chloride of lead is here subjected to the action of nitric acid, equal in weight to about one-fourth of the chloride, which may be either concentrated or diluted to one-half, or two-thirds, of its former strength, adding fresh acid so long as any chlorine passes off from the chloride of lead into the vessels destined to receive it. The re-

tort, or vessel, containing the chloride of lead and nitric acid, must be furnished with all necessary pipes for applying the acid and conducting off the gas; and, as before stated, is to be constructed of earthenware, glass, or such material as is not acted upon by the acid. This process leaves the lead in the state of hydrate of protoxide, combined with a small portion of nitric acid; which hydrate of protoxide is to be converted into carbonate of lead, after the manner stated in the process first described, that is, beginning with the solution of alkaline carbonate.

Our next, or third process, is as follows:—We first dissolve metallic lead, finely granulated, or its protoxide, in nitric acid, diluted in about eight parts by weight of water, in a suitable vessel, as above stated, and apply a gentle heat thereto by means of steam, or in any other convenient manner, until all the lead is dissolved. We then precipitate the lead by any of the well known alkalies, or earths, in their caustic state: we prefer lime and barytes, because, by adding sulphuric acid to them, they will be precipitated in the solid form, leaving the diluted nitric acid free, to be applied to other useful purposes. We also use acetic acid for dissolving the protoxide of lead, following the same course as with nitric acid. After the precipitate or hydrate of protoxide of lead has been thus obtained, it is to be well washed with clear water, in order to remove therefrom the alkali or earthy salt, formed by the chemical combination: the precipitate is now a white hydrate of protoxide of lead. We then cause a stream of carbonic acid gas to pass into the hydrate of protoxide, by means of the well known apparatus called Woulfe's apparatus, which is formed of earthenware, or wood. The carbonic acid gas is generated or obtained in the usual or common method. The current of carbonic acid gas, upon the white hydrate of lead, is to be continuous, or nearly so, and the mixture is to be agitated by frequently stirring the oxide during the operation, which will be much facilitated if the hydrate and water are kept at about the temperature of 120 degrees. In our improved process, we avail ourselves of the combination of the protoxide of lead which takes place when it is boiled, with oily and fatty bodies, until they are converted into oleates, margarates, and stearates; which conversion or transformation is as well effected by oxide of lead as by any of the alkalies or earths. We then displace the protoxide of lead by an alkali, an earth, or their carbonates, which yield carbonic acid to the lead; while the base combines with the fat acids, a stream of carbonic acid gas being applied to the materials under operation, as before stated, for about an hour, in order to ensure the perfect transformation of the protoxide of lead into carbonate of lead; which carbonate is to be well washed from all adhering salts, or other extraneous matters, as before stated: or we may use diluted sulphuric acid, and boil the mass until all the protoxide of lead is precipitated as a white sulphate, which is to be formed into a carbonate, as already described.

In the foregoing processes, we do not claim the use of nitric acid or acetic acid, as solvents of lead, or its protoxides for the purpose of forming white lead; but we claim the use of sulphuric acid for converting the chloride of lead into a hydrated protoxide of lead, and afterwards into a carbonate of lead, and also the chloride of lead thus used. We likewise claim the precipitating the oxide of lead from the nitric and acetic acids, by caustic alkalies, or earths, instead of the carbonates, and afterwards removing them, and washing the precipitate before we form them into a carbonate of lead; and we claim the forming the hydrate of protoxide of lead, from whatever acid it is precipitated, into a carbonate of lead, and not, as in the

common way, precipitating it from a solvent by means of carbonates of alkalies.

We also claim the use of such particular earths, as lime and barytes, as the nitric and acetic acids may be recovered from them by the mere application of as much sulphuric acid as will just saturate the lime or barytes, and that these acids may then be employed for other useful purposes. We likewise claim the application of hydrate of protoxide of lead, formed, as described, from sulphate or hydrate of lead, for the purpose of being converted into a carbonate; and likewise the passing a current of carbonic acid gas through the hydrate, to effect its thorough transformation into carbonate. We likewise claim the use of the oleates, margarates, and stearates of protoxide of lead, as substitutes for acetic and other acids in the production of carbonate of lead, or white lead, for the purpose of converting the hydrate of protoxide of lead into carbonate of lead. Lond. Journ.

Specification of a Patent granted to EDWARD STOLTE, *of the county of Middlesex, for his invention of improvements in making sugar from sugar-cane, and in refining sugar.* Sealed 24th February, 1838.

The constituent parts of this invention are, the application of a new chemical agent, to be used for destroying any colouring matter that may be found in sugar. Animal charcoal has been very generally employed for this purpose for some time, and is now in very common use. The decolouring qualities of sulphurous acid are also already sufficiently known, and, therefore, need not be further noticed here; but another great advantage which may be derived from the use of this agent, for neutralizing the colouring matter in sugars which have been previously operated upon by lime, is, that the alkali is precipitated by the sulphurous acid, and prevents any fermentation of the saccharine matters from taking place.

The method employed for carrying this invention into effect, is described by the patentee in the following manner:—To the saccharine matters is added from one to two thousandth parts of lime, so that in a boiler containing one thousand pounds weight of juice, about two pounds of lime should be employed; and when the juice is boiling, the scum, or dirt, which rises to the surface, must be taken away, and twelve pounds of sulphurous acid in a liquid state (at four degrees of Beaume's areometer) is then to be poured in slowly, and with care; after which the juice is to be evaporated to about the thickness of twenty or twenty-two degrees, and afterwards passed through a filter, of flannel or other suitable substance, and concentrated until it arrives at the proper degree for crystallization.

In the first process of crystallization, it is necessary that great care should be observed that the syrup is not too thick, because if that attention is paid to the operation, a second crystallization may be obtained, which will yield from twenty to thirty per cent. of sugar, if the first process of boiling has not been pursued too far.

The process of refining sugar of a very bad quality must be modified in a slight degree, and somewhat after the following manner:—A very strong concentrated alcohol or spirit, charged with about two per cent. of sulphurous acid, is employed, and this is to be mixed with such a suitable quantity of saccharine matter, that a small portion only of the liquid will float upon the surface. The mixture is then to be stirred several times, and after about two hours the liquid should be drawn off, and the sugar washed in pure alcohol.

The molasses is dissolved by this process, and may be drawn off by a cock, and the pure and crystallized sugar being insoluble in alcohol, will remain beautifully white and clear in the vessel. The alcohol, or spirit, that has been used in the before-mentioned process of washing the sugar may be distilled from the molasses, and, of course, again employed for the same purpose. Ibid.

Specification of a Patent granted to William Barnett, *of the county of Sussex, for his invention of certain improvements in the manufacture of iron.* Sealed 10th July, 1838.

This invention consists simply in the adaptation of carburetted hydrogen gas, and the tar produced in the manufacture of such gas, together with atmospheric air, to the manufacture of iron. The hydrogen gas may be used either separately, or in combination with either the tar or a jet of atmospheric air, propelled with considerable force into the furnace by means of a force pump, or other suitable apparatus.

The patentee disclaims the use of carburetted hydrogen gas for the purpose of imparting certain qualities to the iron, and confines his claim of originality to the use of the gas, either separately, or in combination with either the coal tar or atmospheric air, merely for the purpose of economising fuel; and he does not lay claim to any particular form of apparatus to be employed to carry out the invention, as it is evident that the same must be considerably varied to suit places and circumstances. Ibid.

Specification of a patent granted to James Vincent Desgrand, *of the city of London, for a certain New Pulpy Product or Material to be used in Manufacturing Paper and Pasteboard, prepared from certain Substances not hitherto used for such purposes.*—Sealed May 15, 1838.

The object of the patent consists in making paper and pasteboard with wood, reduced into a state of paste; therefore my right of patent extends not only to the process of employing wood, but to the employment of the material itself. Among the different sorts of woods, I find that those which answer the best are those coming under the classification of white woods, such as poplars. I confine my patent to pure wood, exclusive of every possible bark or epidermis.

Process.—When the trees are entirely deprived of their bark or epidermis, they are cut in logs of about four to six feet long; these logs are split in pieces of about two to six inches each way; these pieces of about four to six feet long, and about two to six inches thick, are carefully assorted in their various shades or colour, as you can make at less expense white paper out of the whitest pieces, as well as you can make coloured paper without any addition of colouring matter; if these shades were wanted out of the shaded pieces, and by the addition of colouring matter, you can produce all sorts of shades requisite with the white and with the coloured pieces of wood. The above pieces of wood of four to six feet long, and two to six inches thick, are chopped in small chips of about two to four inches long, and one to three inches in thickness, taking care to chop them so as to make as many openings or splinters in the chip as possible; the more open they

are, the more freely they admit the liquor of which hereafter mention will be made, which liquor divides and separates the different fibres forming the texture of the wood. In doing the operation of chopping, it is necessary to reject all knots of the wood, all decayed parts, and all parts the fibres of which are not straight.

When you have a sufficient quantity of chips of one shade, they are deposited in a pit, water tight, in which there is an outlet for water, these pits being of a sufficient capacity to contain about half a ton of chips, then you pour over them, so that they should be entirely covered, what in France is known under the name of *lait de chaux*, which is in fact water saturated with lime as much as it will admit, the chips remain in that bath more or less according to the temperature. In the south of France, from three to six weeks were necessary to complete the action of the lime water, which action has for its object to dissolve the glutinous parts of the wood which keep the different fibres of the wood united together. You may be sure of the efficacy of the bath, when all the chips have sunk to the bottom of the pit, and not left any floating. When the chips are sufficiently dissolved, the saturated water is let out and replaced by a sufficient quantity of natural water, so as to wash away all the lime water, or as much as possible. In that state you may easily separate by the hand the fibres of the chips, but for employment they are submitted to the action of the stampers, or fulling mallet, to pound them; this pounding has for its object to open, divide, and flatten the fibres of the chips, and facilitate the further process they have to undergo in the usual paper engine or cylinder to reduce them into pulp. When the pulp is sufficiently reduced by the paper engine, it is in a fit state to make paper or pasteboard, either by itself, or mixed with the usual material generally employed for manufacturing paper or pasteboard, and you may employ it by a paper machine or by frames.

In using the paper engine, as now in operation, for preparing rags or other usual materials, care must be taken to employ the same sort of tackle, but use it very blunt or dull. If for white paper, the fibres, after they have been pounded and flattened and divided, are submitted to the action of the several chemical products which have the property of bleaching vegetable produce.

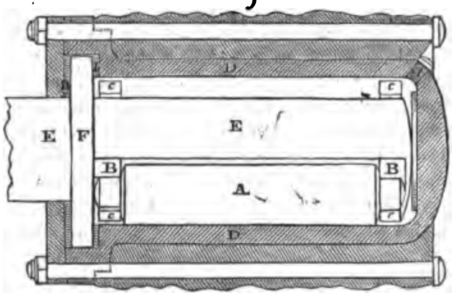
Rep. Pat. Inv.

Specification of the patent granted to John Ball, *of Finsbury Circus, in the county of Middlesex, Merchant, for certain Improvements in Carriages.*—Sealed May 3, 1838.

The object of the invention is to decrease friction in the draft of wheel carriages, and consists of a mode of applying friction rollers to the axletrees of the wheels of carriages, and I would in the first place remark, that I am aware that friction wheels or rollers have before been applied to the boxes of the axletrees of wheel carriages in such a manner that they revolve with the axletree boxes, and around the axletrees. But according to this invention, the friction wheels are applied to the axletrees, and the axletree boxes revolve on the friction rollers, hence the friction rollers remain stationary as to position with the axletrees to which they are applied, and they reduce the friction of the axletree boxes by supporting such boxes, and touching at only a very small part of the inner circumference of each of the boxes, as will be fully described hereafter.

***Description of the Drawing.*—Fig. 1, is a longitudinal section of part of the nave of a carriage wheel, axletree box, and axletree, and the means of affixing the box in the nave, and also the means of fixing the axletree in the axletree box.**

Fig. 1.



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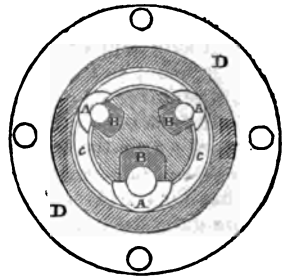

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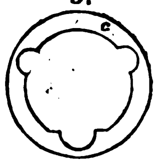

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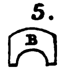


7.

4.

Fig. 2, is a transverse section of fig. 1; and,

Figs. 3, 4, 5, 6, and 7, are some of the parts shown separately. In each of the figures, the same letters indicate similar parts. A, A, A, are three friction wheels, which I prefer to be of steel, well tempered, and they should be accurately made, they having suitable necks formed at each end, on which they move as axes. B, B, are hollow bearings of steel or other suitable metal, which are let into the axletree E, there being suitable grooves or recesses formed in the axletree to receive them, and also to receive the rollers, A, in such manner that the rollers do not touch the axletree, they being simply carried by the bearings, B, let into the recesses formed in the axletree, as is clearly shewn in the drawing. C, C, are collars which have recesses or grooves formed for the necks or axes of the rollers, A; these collars, C, fit on to the axletree, and confine the rollers, A, thereto, allowing them to turn freely on their own axes or necks between the bearings, B, and the recesses in the collars, C. The axletree box, D, is cylindrical, the nature of which is shewn in the drawing; it should be accurately made and well hardened on the inner face, and the rollers, A, should each touch the box, and fit loosely therein, but capable of turning freely. *d*, is a screw to introduce oil for lubrication. F, is a fixed projecting ring on the axletree, and G, is a circular plate which retains the axletree in its place by means of four screw bolts, as is shewn.

Having thus described the invention, I would remark, that although I have shewn only three rollers, A, it is evident that more may be employed if desired, the invention not relating to the number of rollers employed, but only to the mode of employing the same, and I would have it understood, that what I claim as the invention is the mode of applying friction rollers to reduce the friction of the shaft of wheel carriages as herein described.

Ibid.

Specification of a patent granted to LOUIS ELISEE SEIGNETTE, *of London, for improvements in preserving animal and vegetable substances, being a communication from a foreigner residing abroad.*—Sealed 21st March, 1836.

The patentee, in his specification, has described several modes of preserving animal and vegetable substances, but they are all founded upon the the same principle, namely, preventing oxygen from coming into contact with the substances to be preserved. The first process employed by the patentee is as follows:—He takes the meat, either raw or partly cooked, and places it in a solution of salt and nitre for from four to twelve hours, according to the size of the pieces to be preserved. The meat is then packed in tin cases, and the atmospheric air contained therein is to be exhausted by an air pump or otherwise, so as to form a partial vacuum, which must be filled up with a solution of salt and water, or brine; the tin case must then be reversed or placed head downwards in a vessel containing salt and water, and a quantity of carbonic acid gas is then allowed to run in from a pipe, or be pumped in, which will displace the salt and water; the tin case must then be fastened up in an air-tight manner.

The next method in which the patentee proposes to preserve animal and vegetable substances from decay, is somewhat similar to the above, and rather more advantageous. By this method he does not require any vacuum to be made by means of an air pump, but merely fills the tin case with brine when ready packed with meat, and then reverses it, as in the former process, in a vessel containing salt and water, and allows the carbonic acid gas to run into it; and to counteract or prevent the effects of any oxygen, a small bag of iron filings, or small pieces of iron, is put in the top of the case; and as the specific gravity of oxygen is less than that of carbonic acid, the oxygen will naturally rise to the upper part of the vessel, and enter into combination with the iron placed there for that purpose.

In the third process, the patentee dispenses with the use of salt and water and nitre altogether, and instead thereof he employs vinegar, in which he steeps the substances to be preserved; the tin cans are also filled with vinegar, which is displaced by the carbonic acid gas, as in the other process.

The patentee here observes, that it may be as well to introduce a small piece of calcined charcoal into the upper part of each case, to counteract or destroy any disagreeable smell that may arise.

In preserving fish, the patentee says it should be lightly salted, and treated in other respects in the same manner as other animal substances; and to preserve vegetables, they should be first plunged into boiling hot water, to preserve their form, and prevent them from changing colour.

Lond. Journ. Arts.

Specification of a patent granted to JOSHUA JOHN LLOYD MARGARY, *of the county of Middlesex, for his invention of a new mode of preserving certain animal and vegetable substances from decay.*—Sealed 19th December, 1837.

The patentee states: I take sulphate of copper, which salt of copper I pre-

fer, being the cheapest, and to every pound avoirdupois I put five gallons of water, either warm or cold, but warm water will dissolve it soonest. When thoroughly mixed in a wooden or other suitable cistern, I let it run upon the substance that is to be acted upon, which, if timber or wood of any kind, should be fixed in a tank made of wood, or any suitable material, and allowed to remain in the solution two days for every inch of thickness, but to ensure durability, the longer time that large beams remain the better.

The timber should be submitted to the process in a perfectly dry state, in order that it may absorb as much of the solution as possible. Canvass should be immersed in the said tank in layers, the better to ensure complete saturation, and should remain in the solution till completely saturated, say for from eight to sixteen hours, according to its thickness, then put to drain, and afterwards hung up to dry, when it will be fit for use.

Rope is twisted so hard, that it would take a long time to saturate, and it is best saturated with the solution when in the state called strands, or of twine; and linen, or cotton, thread, or cloth, or woolen, or worsted yarn, I submit to the operation of the solution of the tank as aforesaid: paper may be spunged over with the solution on both sides, but it is best to mix the solution with the pulp: parchment, leather, and skins, I also place in the tank, and a very short time is sufficient for parchment to remain in the solution; when completely moist, it may be taken out and dried, and will be fit for use. Skins should remain in the solution, according to their thickness, from one to ten days.

Now, whereas, if acetate of copper be used, and acid should be employed to dissolve it, I should then mix one pound avoirdupois of acetate of copper with two quarts of pyroligneous acid and fourteen quarts of water, and then it may be used in the tank in the same manner as sulphate of copper, which dissolves in water, as before described. And, whereas, the certain substances to which I allude in the title of my said invention, are timber and wood of all kinds, canvass or other cloth, whether hempen, flaxen, cotton, or woolen, the threads also of which such cloth is wove; and rope, twine, hemp, flax, cotton, and wool, paper, parchment, leather and skins.

And, whereas, I claim as my invention, the wetting, saturating, steeping, or soaking, of the said substances with or in such solutions of sulphate of copper as aforesaid, for the purpose of preserving the same from decay.

Ibid.

Specification of a patent granted to Benjamin Cook, *of Birmingham, for his invention of an improvement in gas burners, commonly called or known by the name of Argand burners.*—Sealed 9th December, 1837.

The patentee states, that all Argand burners hitherto used for the consumption of gas, have had the apertures through which the gas passes at the top of such burners drilled in vertical directions, in order that the flame might ascend perpendicularly; he however, conceives that there would be an advantage in drilling the holes for the escape of the gas in the sides of the burners, or at least at considerable angles from the perpendicular.

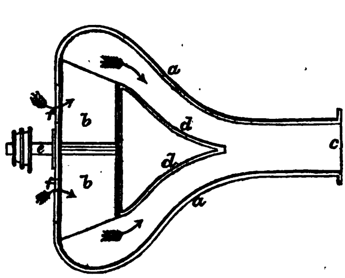
The advantages proposed are, that the flames issuing from the holes by these means would pass through a larger space, and be thereby enabled to consume a greater portion of the oxygen of the atmosphere, and, necessarily give out a greater degree of illumination, with an economised consumption

of the gas. The invention, therefore, consists solely in drilling or perforating the holes through the sides of an argand gas burner at any angle that may be found most eligible. Ibid.

Specification of a patent granted to Jacob Perkins, *of the city of London, engineer, for his having invented certain improvements in blowing and exhausting air, applicable to various purposes.*—Sealed 9th June, 1832.

This is a rotary blowing apparatus of a peculiar form, having the fans of the blower shaped like the section of a frustrum of a cone.

The annexed drawing exhibits the apparatus in section, consisting of an outer case, *a*, *a*, enlarged in the part where the rotary fan, *b*, *b*, is situate, and contracted into a nozle at *c*, for the purpose of guiding the volume of air intended to be forced into the furnace. There is also a partition *d*, *d*, forming the curved channel, as a guide to the blast.



The rotary fan, *b*, has four, or any other number of, vanes fixed radially upon an axle, *e*, which turns in bearings in the case, and is made to revolve by any convenient means. The atmospheric air passes into the apparatus through apertures at *f*, *f*, as shown by the arrows, and by the rotary action of the fan wheel *b*, is forced through the curved channel, and out at the nozle *c*.

This arrangement of the apparatus, it will be perceived, is only calculated for injecting a blast of air into a furnace, but a similarly contrived rotary fan might be adapted for exhausting the air, smoke, and vapour from the flues of a furnace, by placing the apertures *f*, *f*, in connexion with the flue, when the rotary action of the fan would draw the air, smoke, and vapour through the apparatus, and eject it at the mouth or nozle *c*. Ibid.

Progress of Practical and Theoretical Mechanics and Chemistry.

Iveson's *Patent Mode of effecting the Combustion of Smoke.*

Smoke has always been regarded as a nuisance, and for a long time as a waste of fuel. As the age of steam advanced, and as its benefits were diffused over, and enriched the face of the earth, so did the concomitant evil, smoke, throw a cloud abroad, which bade fair to obscure the face of the sky. So great became the evil, that in process of time every one not directly interested in its cause complained aloud, and seemed willing to forego the

grand effects of the steam engine rather than put up with its smoke. Petition upon petition poured into the Houses of Parliament, praying the legislature to compel the manufactories to put out their fires or swallow their smoke. Learned societies offered premiums to incite their members to search for an antidote; chemists and mechanicians racked their brains to obtain the desired secret. A parliamentary committee was appointed to examine into the subject; and numerous were the plans which were brought under its notice, and described in the reports of its proceedings. An act was the result of this inquiry, rendering manufacturers indictable for a nuisance if the smoke of their chimneys annoyed their neighbours, and giving the judge power to compel the culprit to adopt any efficient plan for remedying the evil. This law has, however, never strictly been enforced, but the fear of its infliction compelled many to try and adopt various plans for either consuming or doing away with the offending vapour. Chimneys hundreds of feet high were built; hoppers, reverberatory furnaces, and numerous other devices were patented, or suggested, (not a few in our pages) and carried into operation. Some few succeeded, and are in use to this day; a greater number failed, and have gone to the "tomb of all the Capulets." Another incentive than that of fear of the law, has, however, been of late stirring up inventors to devise a plan to consume the smoke of the manufacturer's furnace. Competition has compelled the users of steam power to economise in the means of producing that power. The capability of the fuel to produce heat has been pushed to the utmost. Now the dregs —the smoke—only remains, and that must, and will, be turned to profitable account, and love of gain will effect what fear of loss could not accomplish.

If the expectations which have been raised in the present instance prove to be well founded, the bane has been found to carry with it its antidote—a small jet of steam seems to be all that is necessary to disperse a vast column of smoke. *Auld Reikie* is the birth place of the discovery now under notice; that city will now, mayhap, deserve this title no more; she will purify herself of her soot, and appear as fair as any city of the south.

For these last few weeks the papers and periodicals of the day have been teeming with paragraphs setting forth the enormous advantages of the grand discovery made by Mr. Iveson of Edinburgh, and detailing some strikingly important experiments stated to have been made by various eminent men upon the invention.

We are now enabled to present our readers with a correct description of Mr. Iveson's plan, to enable them to form a judgment for themselves upon its merits, and of its likelihood to answer the desired end. We confess that we are by no means satisfied that the advantages set forth as the result of the experiments are obtainable from the plan described. We think also that the theory by which it is endeavoured to account for the extraordinary result stated, that of a saving of forty per cent., is erroneous.

In the statement circulated by the patentee, the process is described to be "peculiarly simple, and of cheap and easy application, and may be adapted to any existing furnace in a short time. It consists in the admission of steam into the furnace, and discharged over the fuel at any expedient place. The best and easiest method is by the introduction of a pipe from the boiler above the door of the furnace, with a fan-shaped termination suitable to the size of the furnace, reaching beyond the dumb plate, and perforated with minute apertures, so as to throw the steam in small jets down upon and over

the whole breadth of the fire. The quantity required does not exceed one-tenth of the steam generated.

"The effect of the process is the prevention of smoke, and, *under proper management*, the creation of a great additional amount of heat. As the quantity of fuel is much diminished, it is necessary to contract the fire space considerably in height and width, but leaving the same surface of the boiler exposed to the fire; to raise the back bridge so as to contract the throat; and also, a little way beyond the bridge, to construct an inverted arch, which will propel the flame downwards, and precipitate the ashes. The lower part of the arch must be on a line with the upper surface of the bridge; and the space between them may be equal to that between the bridge and the boiler.

"As the introduction of steam into the furnace greatly increases the draft, it must, in other respects, be checked by every expedient means; it is necessary to work with the damper much lower than usual, and the great height of the chimney stack will be unnecessary. The fresh fuel should be placed, in the first instance, on the dumb or charring plate, so as to cause the flame and smoke to be exposed to the action of the steam."

We observed by the Edinburgh papers, that Mr. Iveson's plan had been applied to the *Royal Adelaide* steam ship, trading between Leith and London, and we looked forward with considerable interest for her arrival in the Thames to witness the working of the plan. We are sorry to have to state that the application has in this instance not succeeded. Perhaps the failure was owing to the difficulties and disadvantages always incident to first experiments and early workings of new operations; or it might be for want of the "proper management" stated in the preceding quotation to be necessary to obtain the great saving in fuel set forth as the result of the previous experiments; and if such be the case, we shall be happy to be able to publish the causes of the failure, if the parties interested think fit to supply us with them.

The boilers of the Royal Adelaide have one of the pipes, with fan shaped terminations to each furnace. During the whole of the voyage, the engineers experienced a great scarcity of steam for the engine, and about six hours more than the usual time were occupied in performing the voyage. The fire bars also were completely destroyed. The smoke, however, was almost entirely consumed. The furnaces were consequently restored to their original condition, and the Adelaide returned to Leith belching forth dark clouds of smoke as was her wont; nay, the smoke seemed even to rise higher, and spread abroad its murky shadow with renewed vigour, as if in triumph over the defeat of its would-be vanquishers.

Still, therefore, will the steamer's vapoury pennant roll in the breeze, and still will "the smoke that so gracefully curls," indicate the approach from the broad Atlantic of the steamship that, more truly than its rival, of which the words were written,—"Walks the water like a thing of life."

Lond Mech. Magazine.

On the Application of Anthracite for Smelting Purposes.

It is only a short time since the anthracite which is obtained in the south-west of Wales has been applied to the purposes of smelting, for although it does not decrepitate so violently as that from the neighbourhood of the Alps,

the different experiments which had been made, whether to burn it alone, or with a portion of coke, had not succeeded. The limit of three-fifths of anthracite to two-fifths of coke, could not be surmounted without decreasing the heat of the furnace.

It is only one year and a half since Mr. George Crane, of the Yniscedwyn Foundry, near Swansea, conceived the idea that the introduction of a current of warm air would remedy this inconvenience. The question was of double importance to that gentleman, as his furnace was situated in the anthracite district, whereas he was then obliged to use coal which had to be transported some distance. The first experiment, which he made in February, 1837, with anthracite only, succeeded admirably. Before speaking of the effect which the use of anthracite has upon the products of the furnace, I will mention a few circumstances relative to the occurrence of the material, and I shall conclude by examining the properties of the anthracite of Wales, compared with that of the Alps, in order to form an opinion whether that of France can be as successfully applied as that of England.

The greater portion of the coal basin of the south of Wales furnishes a mineral possessing considerable bituminous qualities, but gradually, as you approach the west, the coal measures become more dry, and the ten lowest beds, situated above the iron line, which is superincumbent on the millstone grit, furnish a material possessing all the properties of anthracite, and denominated, on that account, stone coal. This singular variation cannot be accounted for, as there is no rock of Plutonic origin in the department.

The mineral is hard, but it breaks easier than some varieties of anthracite from the department of Lamure. Generally it is of a black colour, passing into gray, with a semi-metallic lustre, vitreous, and conchoidal fracture, and does not soil or mark upon paper. When subjected to a temperature of 100°, the anthracite of Yniscedwyn yields 0.03 of pure water. A specimen, entirely free from pyrites, which was analysed by M. Regnault, yielded, after the reduction of 1.58 for the ashes which remained—

Hydrogen	3.38	
Carbon	94.05	
Oxygen and azote . .	2.57	—100.00

On being ignited, the anthracite of Wales burns with a clear, short flame, without smoke, but only of short duration. It then decrepitates, but the fragments retain their form. Some of the anthracite which is worked in the *brass vein* of Yniscedwyn, encloses a considerable proportion of iron pyrites, either in discernible or minutely disseminated particles. It is used promiscuously with the other varieties, if the metal is not required to be of the first quality; but if otherwise, it is previously calcined, in order to drive off a portion of the sulphur.

The mineral found at Yniscedwyn occurs in veins traversing schistus slate, and contains iron pyrites and phosphate of iron. An analysis afforded 0.004 as the mean proportion of the latter substance. The experiments relative to the anthracite were made in furnaces which were to be destroyed, on account of the surplus amount of combustible they consumed. The charge of three cwt., one half of which was coke, only carried three to three and a half cwt. instead of five to five and a half cwt. of ore, as in other furnaces. This circumstance is worthy of remark. As one blast serves for more than one furnace, I could not ascertain the volume or the current of the air employed; but the machine, recommended by Mr. Crane, for the purpose of supplying three furnaces constructed for anthracite, yields 10,500 cubic feet

of air, at the pressure of two and a half lbs. per cubic inch, equal to nearly twelve and a half centimetres of mercury; in the greater number of furnaces the pressure varies from two to two and a half lbs.

The air, before entering the tube, is heated to 620° Fahrenheit, by means of an apparatus slightly modified from that of Calder. All the data tend to prove that the principal difference between the advantages of the common furnace, and the corresponding work of a cold-blast coke furnace, is a considerable increase of temperature towards the base of the furnace. This is not only attributable to the heating susceptibility of anthracite, but also to its superior density. It is thought that these two circumstances ought to develop a much higher temperature than in any other case, as soon as a sufficient energy is afforded to the combustion; and for this purpose the hot air has been adopted.

Since the employment of anthracite, the proportion of foreign ingredients in the slag has been reduced to three-fourths its original contents.

Those of ordinary manufactures are generally vitreous, and the edges of the fragments are translucent. Of all the slag formed by high temperatures, these have the greatest tendency to crystallize. The fracture is generally of a vitreous nature, and greenish gray colour, with a lamellar appearance. In examining them attentively, I have observed small crystals disseminated throughout the mass, bearing the appearance of idocrase, or olivine.

The composition of the slag is as follows:—

Silex	44.6
Chalk	30.8
Magnesia	3.8
Alumina	15.8
Protox-iron	3.1
Sulphur	0.011—98.1011

This analysis resembles that of the slag obtained at Dowlais, but the temperature differs materially in the two cases. The principle of the introduction of hot air is to increase the susceptibility of combination, the air acquiring a considerable increase of chemical energy by the increase of warmth, so that it becomes disengaged from a great proportion of oxygen which it retains when cold.

Experience has shown, that the increase of intensity of the combustion has been the means of increasing the power much more than the diminution of the density of the air; consequently the temperature, which is proportionate to the quantity of combustible used in the same time, and in a similar space, ought to be much higher in the first case than in the second; in fact, the air being deprived of the oxygen, has a less degree of heat, and the uppermost particles do not acquire warmth except by means of the heat collected by the gas. From this, it appears, that a great heat ought to be concentrated, whilst the uppermost volume of air is less heated than in other furnaces.

The metal runs readily from the hearth; it is perfectly white, and possesses an almost perfect liquidity, which it retains for a longer time than ordinary. When cold, it is gray, fine grained, and easy to be polished. It is very tenacious, and Mr. Crane remarks, that it is about 25 per cent. more so than that which was obtained from the same furnace, and the same mineral formerly. It is rather astonishing, that the metal obtained with a combustible containing a larger proportion of pyrites than coke, should be so much superior to that commonly obtained by the ordinary means. This de-

sulfuration is the result of a greater increase of temperature. The sample of the slag which was analysed, contained merely 0.001 of sulphur; but judging from the smell of sulphuretted hydrogen which the slag gives out when rubbed with water, I am of opinion that the amount is more considerable.

This fact proves, that the metal obtained by means of hot air, is as tenacious as that produced under the same circumstances by the employment of cold air.

The quantity of carbon, silex, sulphur, and phosphorus contained in the metal smelted at Yniscedwyn, has been stated as follows:—

Carbon	0.0230
Silex	0 0130
Sulphur	0.0030
Phosphorus . . .	0.0048—0.0438

By the old method, four or five tons of coal, at the rate of 4s. 6s. per ton, were consumed to produce one ton of metal; but from the average of three months' observation, it appears that only 1 ton 7 cwt. of anthracite (not including that employed for heating the blast) was consumed. Anthracite of the best quality is worth 5s. the ton; but that which is commonly consumed averages only 3s. 6d., so that the quantity consumed has been reduced to the proportion of 18 to 5. This consumption of anthracite, in the proportion of 1.35 to 1. of metal, is much less than that of the furnaces in the neighbourhood, where coke is used; but it would appear, at first, that with a like temperature towards the base of the furnace, and a combustible material as compact, the gases originating from the combustion ought to be the means of a considerable loss of heat; but the effect of the hot air, as stated above, proves the contrary.

Thus we see how great are the advantages arising from the employment of anthracite in the manufacture of iron, whether as regards the economy, or the quality of the iron.

1st. It has brought into use a combustible mineral found in the neighbourhood, cheaper than bituminous coal, and consequently much less expensive than coke, and of which a much smaller quantity is required.

2dly. The quality of the iron has been sensibly improved by the use of it.

The anthracite found in many parts of France has not the identical properties of that of Wales, for the same effect has hitherto been unattainable in France.

It is known, that in the department of Isere, the mineral is found in the immediate neighbourhood of the fuel, and it was this circumstance which led to the experiments of 1833, but which have merely led to the scientific solution of the question.

The anthracite of Lamure contains—

Hydrogen	1.75
Carbon	94.07
Oxygen and azote . .	4.18—100.00

which differs from the Welch anthracite, where the proportion of hydrogen is much larger. Though the results which have been obtained in the laboratory are unsatisfactory, they do not impede or nullify the possibility of

its employment in the blast furnace.—*M. Daubrée. Annales des Mines, vol.* 14. Min. Rev.

Photogenic Drawings.

"At the last sitting of the Academy of Sciences, M. Arago announced one of the most important discoveries in the fine arts that has distinguished the present century, the author of which has already acquired universal reputation by his miraculous diorama—M. Daguerre. It is well known that certain chemical substances, as chlorate of silver, have the property of changing their colour by the mere contact of light; and it is by a combination of this nature that M. Daguerre has succeeded in fixing upon paper prepared with it, the rays that are directed on the table of the camera obscura, and rendering the optical tableau permanent. The exact representation of whatever objects this instrument is directed to is, as every body is aware, thrown down with vivid colours upon the white skreen, prepared to receive them, and the rays of light that are thus reflected have the power of acting in the way above alluded to, on chlorate of silver, or certain preparations of it. In this manner an exact representation of light and shade, of whatever object may be wished to be viewed, is obtained with the precise accuracy of nature herself, and it is stated to have all the softness of a fine aqua-tint engraving. M. Daguerre had made this discovery some years ago, but he had not then succeeded in making the alteration of colour permanent on the chemical substance. This main desideratum he has now accomplished, and in this manner has been able, among other instances, to make a permanent chemical representation of the Louvre, taken from the Pont des Arts. M. Arago, in commenting upon this most extraordinary discovery, observed that a patent would be by no means able to preserve the rights of the discoverer sufficiently to reward him for his efforts; and he therefore urged the propriety of an application being made to the legislature for a grant of public money as a recompense. M. Biot, on the same occasion, compared M. Daguerre's discovery to the retina of the eye, the objects being represented on one and the other surface with almost equal accuracy.

"What is the secret of the invention? What is the substance endowed with such astonishing sensibility to the rays of light, that it not only penetrates itself with them, but preserves their impression; performs at once the function of the eye and of the optic nerve—the material instrument of sensation and sensation itself? In good sooth we know nothing about it. Figure to yourself, says a Parisian contemporary, a mirror, which, after having received your image, gives you back your portrait, indelible as a picture, and a much more exact resemblance. Such is the miracle invented by M. Daguerre. His pictures do not reproduce colour, but only outline, the lights and shadows of the model. They are not paintings; they are drawings; but drawings pushed to a degree of perfection that art never can reach.

"One has heard of writing by steam, but 'drawing by sunshine' (or moonshine) is a novelty for which the world is indebted to M. Daguerre, of Paris, the diorama painter. M. Arago and M. Biot, who have made reports to the Academy of Sciences on the effect of M. Daguerre's discovery, have given up all attempts to define its causes. The complaisance of the inventor has permitted us to see these *chefs d'œuvre*, where nature has delineated herself. At every picture placed before our eyes we were in admiration.

What perfection of outline—what effects of *claro obscuro*—what delicacy—what finish! But how can we be assured that this is not the work of a clever draughtsman? As a sufficient answer, M. Daguerre puts a magnifying glass in our hand. We then see the minutest folds of the drapery, the lines of a landscape, invisible to the naked eye. In the mass of buildings, accessories of all kinds, imperceptible accidents, of which the view of Paris from the Pont des Arts is composed, we distinguish the smallest details, we count the stones of the pavement, we see the moisture produced by rain, we read the sign of a shop. Every thread of the luminous tissue has passed from the object to the surface retaining it. The impression of the image takes place with greater or less rapidity, according to the intensity of the light; it is produced quicker at noon than in the morning or evening, in a summer than in winter. M. Daguerre has hitherto made his experiments only in Paris; and in the most favourable circumstances they have always been too slow to obtain complete results, except on still or inanimate nature. Motion escapes him, or leaves only vague and uncertain traces. It may be presumed that the sun of Africa would give him instantaneous images of natural objects in full life and action."

The invention has since been the subject of discussion at the Royal Institution in London; and we have been told that in some of the specimens exhibited, so perfect was the resemblance of the picture produced to the original, that the very threads and fibres of a person's garments were plainly shown.

Lond. Mech. Mag.

Photogenic Drawing.

The subject (says Mr. Talbot) naturally divides itself into two heads—the preparation of the paper, and the means of fixing the design. In order to make what may be called ordinary photogenic paper, the author selects, in the first place, paper of a good firm quality, and smooth surface; and thinks that none answers better than superfine writing paper. He dips it into a *weak* solution of common salt, and wipes it dry, by which the salt is uniformly distributed throughout its substance. He then spreads a solution of nitrate of silver on one surface only, and dries it at the fire. The solution should not be saturated, but six or eight times diluted with water. When dry, the paper is fit for use. He has found, by experiment, that there is a certain proportion between the quantity of salt and that of the solution of silver which answers best, and gives the maximum effect. If the strength of the salt is augmented beyond this point, the effect diminishes, and, in certain cases, becomes exceedingly small. This paper, if properly made, is very useful for all ordinary photogenic purposes. For example, nothing can be more perfect than the images it gives of leaves and flowers, especially with a summer sun. The light passing through the leaves, delineates every ramification of their nerves. If a sheet of paper, thus prepared, be taken and washed with a *saturated* solution of salt and then dried, it will be found (especially if the paper has been kept some weeks before the trial is made,) that its sensibility is greatly diminished, and, in some cases, seems quite extinct. But if it be again washed with a liberal quantity of the solution of silver, it becomes again sensible to light, and even more so than it was at first. In this way, by alternately washing the paper with salt and silver, and drying it between times, Mr. Talbot has succeeded in increasing

its sensibility to the degree that is requisite for receiving the images of the camera obscura. In conducting this operation, it will be found that the results are sometimes more, and sometimes less satisfactory, in consequence of small and accidental variations in the proportions employed. It happens sometimes that the chloride of silver is disposed to darken of itself, without any exposure to the light—this shows that the attempt to give it sensibility has been carried too far. The object is, to *approach* to this condition as near as possible, without *reaching* it; so that the substance may be in a state ready to yield to the slightest extraneous force, such as the feeble impact of the violet rays, when much attenuated. Having, therefore, prepared a number of sheets of paper, slightly different from one another in the composition, let a piece be cut from each, and, having been duly marked or numbered, let them be placed side by side in a very weak diffused light, for about a quarter of an hour; then, if any one of them, as frequently happens, exhibits a marked advantage over its competitors, Mr. Talbot selects the paper which bears the corresponding number to be placed in the camera obscura.

With regard to the second object—that of fixing the images—Mr. Talbot observed, that, after having tried *ammonia*, and several other re-agents, with very imperfect success, the first which gave him a successful result, was the iodide of potassium, much diluted with water. If a photogenic picture is washed over with this liquid, an *iodide of silver* is formed, which is absolutely unalterable by sunshine. This process requires precaution; for, if the solution is too strong, it attacks the dark parts of the picture. It is requisite, therefore, to find, by trial, the proper proportions. The fixation of the pictures in this way, with proper management, is very beautiful and lasting. The specimen of *lace* which Mr. Talbot exhibited to the Society, and which was made five years ago, was preserved in this manner. But his usual method of fixing is different from this, and somewhat simpler —or, at least, requiring less nicety. It consists in immersing the picture in a strong solution of *common salt*, and then wiping off the superfluous moisture, and drying it. It is sufficiently singular, that the same substance which is so useful in *giving* sensibility to the paper, should also be capable, under other circumstances, of *destroying* it; but such is, nevertheless, the fact. Now, if the picture which has been thus washed and dried, is placed in the sun, the white parts colour themselves of a pale lilac tint, after which they become insensible. Numerous experiments have shown the author that the depth of this lilac tint varies according to the quantity of salt used, relatively to the quantity of silver; but by adjusting these, the images may, if desired, be retained of an absolute whiteness. He mentions, also, that those preserved by *iodine* are always of a very pale primrose yellow, which has the extraordinary and very remarkable property of turning to a full gaudy yellow, whenever it is exposed to the heat of a fire, and recovering its former colour again, when it is cold.

Brit. Assoc.—Atheneum.

On the Construction of Apparatus for Solidifying Carbonic Acid, and on the elastic force of Carbonic Acid Gas in contact with the liquid form of the Acid, at different Temperatures. *By* Mr. Robert Addams.

Mr. Addams prefaced his communication by adverting to the original production of liquid carbonic acid by Dr. Faraday, in 1823, and also to the solidifi-

cation of the acid by M. Thilorier, and then exhibited three kinds of instruments which he (Mr. Addams) had employed for the reduction of the gas into the liquid and solid forms. The first mode was mechanical, in which powerful hydraulic pumps were used to force gas from one vessel into a second, by filling the first with water, saline solutions, oil, or mercury; and in this apparatus a "*gauge of observation*" was attached, in order to see when the vessel was filled. The second kind of apparatus is a modification of that invented and used by Thilorier. The third includes the mechanical and the chemical methods, and by which, as stated, a saving of a large quantity of acid formed in the generator is effected; whereas, by the arrangements of Thilorier's plan, two parts in three are suffered to rush into the atmosphere, and are lost. With this set of instruments are used two gauges of observation—one to show when the generator is filled with water by the pumps, and consequently all the free carbonic acid forced into the receiver; and the other to determine the quantity of liquid acid in the receiver. He likewise exhibited other instruments for drawing off and distilling liquid carbonic acid from one vessel into another, and mentioned some experiments which were in progress, and especially the action of potassium in liquid carbonic acid,—an action which indicated no decomposition of the real acid, but such as implied the presence of water, or a hydrous acid. A table of the elastic force, or tension of the gas, over the liquid carbonic acid, was shown, for each ten degrees of the thermometer, beginning at zero, and terminating with 150 degrees. The following are some of the results:—

Degrees.	lb. per sq. inch.	Atmospheres of 15 lb each.
0	279.9	18.06
10	300.	20.
30	398.1	26.54
32	413.4	27.56
50	520.05	34.67
100	934.8	62.32
150	1495.65	99.71

Mr. Addams announced his intention of examining the pressure at higher temperatures, up to that of boiling water, and above; and asserted his belief that it may be profitably employed as an agent of motion—a substitute for steam—not directly, as had been already tried by Mr. Brunel, but indirectly, and as a means to circulate or reciprocate other fluids. The solidification of the acid was shown, and the freezing of pounds of mercury in a few minutes, by the cooling influence which the solid acid exercises in passing again to the gaseous state.

Ibid.

On the Possibility of obtaining, by Voltaic Action, Crystalline Metals, intermediate between the Poles or Electrodes.

These observations were in connexion with, and in support of, those laid before this Section last year, by the author, on the same subject.

After drawing the attention of the members to the important influence

exercised by electric currents, and the probability of their affording some insight into the mysteries of the formation of mineral veins, Dr. Bird alluded to the results of the experiments detailed by him at Liverpool, and observed that certain sources of fallacy existed, which he had not then been able to obviate, and which rendered the results less satisfactory; and after making a rapid sketch of the experiments of Fox and others, and pointing out their generally interesting, although unsatisfactory, nature, he proceeded to describe a form of apparatus arranged by Mr. Sandall, of St. Thomas' Hospital, by the aid of which he had obtained results which he considered as conclusive in favour of the possibility of the reduction of a metal intermediate between poles or electrodes. The apparatus consisted of a jar furnished with a *vertical* diaphragm of plaster of Paris, instead of a *horizontal* one, which Dr. Bird had previously used. In one cell of the jar was placed water, and in the other a solution of sulphate of copper. On immersing a compound arc, so that the zinc leg might dip into the water, and the copper leg into the metallic solution, an electric current of course ensued; and at the end of a month the solution of copper became nearly decolorated. On breaking up the apparatus, scarcely any crystals of copper were found on the negative electrode, whilst that surface of the plaster diaphragm bathed by the sulphate of copper, was covered with the reduced metal in a nodular or stalagmitic form. Specimens of the plaster covered with the copper were exhibited; they were exceedingly perfect, as far as metallic lustre and every required character were concerned; differing from those shown by Dr. Bird at Liverpool, in their want of crystalline surface. On breaking the mass of plaster crystals, little veins of copper were found disseminated through it in every direction, presenting a most marked resemblance to those met with, on the large scale, in nature.

Prof. Whewell observed, that the facts brought forward bore more directly upon the production of metallic veins, than any yet laid before the scientific world; and he stated, that, in his opinion, they were conclusive in favour of the important Faradian law—that the passage of an electric current was capable of effecting decomposition of compound bodies without the presence of poles or attracting surfaces. Ibid.

On the Influence of Voltaic Combination on Chemical Action. *By* Dr. Andrews.

In dilute sulphuric acid, composed of one atom of the dry acid and eight atoms of water, the solution of distilled zinc is permanently accelerated, by connecting it with a plate of platina immersed in the same liquid, so as to form a voltaic combination. In acid containing seven atoms of water, the ordinary action is at first increased, and afterwards rather diminished by contact with platina. But when zinc is heated in acid containing less than this quantity of water, the connexion with platina transfers the evolution of gas, from the surface of the positive to that of the negative metal, and at the same time diminishes its quantity, and consequently retards the rate of solution of the zinc. The formation of a galvanic circle exerts, therefore, a reverse effect on the solution of zinc in sulphuric acid, containing more or less than seven atoms of water. The principal circumstances which influence these results are, the adhesion of the hydrogen gas to the surface of the zinc; the formation of sulphate of zinc, which is greatly facilitated by the presence of seven atoms of water in union with each atom of acid (that

being the number of atoms of water of crystallization contained in it;) and lastly, the proper action of the voltaic circle, which tends to diminish the solution of the zinc. In dilute acid, the first circumstance retards the action on the zinc alone, and the second facilitates its solution; then the platina surface enables the hydrogen to escape. But in the stronger acid, the voltaic association impedes the solution of the zinc, partly from the evolution of gas being transferred to the platina, and thus the saturated liquid being allowed to accumulate around the zinc plate; and partly from the real effect of the galvanic combination. That the proper tendency of a voltaic circle is, to diminish the chemical action of the solution on the electro-positive metal, the author endeavoured to show, from the consideration, that in ordinary solution the electricities thus developed have only an indefinitely small portion of liquid to traverse, while in voltaic solution their reunion can only be effected by passing across a column of variable extent, and composed of an imperfectly conducting substance. And, as the action is greater the nearer the plates are to each other, that action ought to attain a maximum when the distance between the plates vanishes, provided this condition could actually be realized.

Idem.

Papier Maché Ornaments, for the "Acteon," Liverpool and Glasgow Steam ship.

We have been favoured, within the last few days, with an inspection, at the manufactory of Messrs. Jennens and Bettridge, of a set of panels in *papier maché*, intended for the decoration of the "Acteon," Liverpool and Glasgow steamer; which, as works of art, have not, we believe, been surpassed by any thing of the kind ever produced at this celebrated establishment. The panels are 28 in number, four of which are very large, and consist of historical subjects, some original, and others copies from the works of celebrated masters. The first represents the triumphal entry of Alexander into Babylon; the second exhibits a view of a Grecian seaport, and the arrival of a victorious fleet; the third describes the Olympic games, the combats of gladiators, &c.; the fourth gives a representation of the Hippodrome, the Temple of Victory, and chariot races. Each of these subjects is depicted by the artist with the vividness and freshness of life. The various groups of Grecian, Egyptian, and Persian figures, the richness and brilliancy of the costumes, the colossal statues, temples, and columns, in their architectural grandeur and beauty, furnish a vivid representation of the barbaric pomp and magnificence of by-gone ages. The smaller panels are divided into the classes, devoted to the illustration of particular subjects. The first series represents full length figures emblematic of Victory, Commerce, and the Arts and Sciences, surrounded with beautiful ornamental work, drawn in imitation of *alto-relievo;* the whole surmounted with the arms of Liverpool and Glasgow. The second embraces mythological subjects, representing the triumph of Neptune, Juno, and the Graces, Actæon, &c.; the whole adorned with an emblematic frame work. The third comprises mosaic heads, and emblems ornamented with arabesque foliage, brds, flowers, and fountains. Viewed separately, each of these paintings is an exquisite specimen of the advanced state of this department of our manufactures and the fine arts; and, as a whole, they form unquestionably one of the most unique and splendid collections of the kind ever produced. The panels will not, we believe, be removed for a few days from the show rooms of

the manufactory, where artists and other visitors may have an opportunity of inspecting them.—*Birmingham Herald.* Lond. Mech. Mag.

Kiln Drying Wheats for Grinding.

We have been lately struck with a passage in the last Quarterly Journal of Agriculture, recommending the process of kiln drying wheats, as applied in Scotland and the North of England to oats. "It is evident," observes the writer, "that all grain intended for household consumption can be readily preserved; but that all meal is less easily kept from the attacks of insects, and is with greater difficulty recovered from the deterioration. We incline to think that the vast superiority of Scotch oatmeal over that which the unfortunate Southerns obtain from English millers, and the great length of time during which the former will remain sweet and good compared with the latter, which will keep useable only a fortnight, is attributable to the method of kiln drying that the Scotch millers adopt, which not only destroys incipient (or perhaps actual) insect vitality, but imparts that richness of flavour which is wholly deficient in English oatmeal. In fact, the mealmen of the South confess they know not how to give the same appearance, taste, scent, or texture, to their oatmeal, that is so apparent and so delicious in that of Scotland.

"We are firmly of opinion that if wheat could be subjected to a similar process to that which is adopted for oats, the results would be the same, namely, that it would keep a much longer time; it would be secured from insects; its flavour would be highly improved in richness and delicacy; it would be decidedly more wholesome, and would require much less time in cooking. Our reasons for speaking thus positively arise from actual demonstration. It is well known that flour from wheat is rejected altogether by the dyspeptic, 'because it lies heavy on the stomach,' 'because it turns sour,' 'because it ferments,' 'because'—twenty other reasons; therefore it is not a fit aliment for young children, where, from ill health or fortuitous circumstances, a mother is unable to nurse her offspring, and recourse is had to extraneous nourishment. Every succedaneum with which we are acquainted has been tried for the food of infants, and not any is so entirely free from objection as this very contemned *wheaten flour*, when it has undergone the process of either baking or boiling for the space of a couple of hours. All crudity is then subdued—it becomes a compact hard mass, which is to be rolled or grated when wanted for use—requires merely heating, not even boiling, to make it palatable, and is in flavour really delicious; it is also light, nourishing, free from all those objections made by the dyspeptic, and moreover will keep free from insects, shall we say *for ever?* if we do, our readers will see that we mean an indefinite period." Ibid.

Reagent for the Detection of Sulphurous Acid, in the Hydrochloric Acid of Commerce. By Girardin.

The hydrochloric acid of commerce often contains sulphurous acid, especially when prepared on the large scale in the alkali manufactories: this contamination cannot be detected by the odour, but in the protochloride of tin we have an excellent test for its presence. For this purpose, crystals

of the chloride should be dissolved in the suspected acid, which, if free from sulphurous acid, will dissolve the chloride, with the production of a very insignificant troubling. If this acid is present, however, the hydrochloric acid becomes rapidly brown, by repose depositing a precipitate of that colour, consisting of an intermediate sulphuret of tin, of protosulphuret, and of chloride of tin insoluble in muriatic acid. This reaction depends upon a portion of the tin becoming oxidated at the expense of the sulphurous acid, another portion uniting with the sulphur, while the oxide of tin thus formed dissolves in the excess of muriatic acid to form an insoluble chloride.—*Journ. für Pract. Chemie.*, 6. 81. Edin. N. Philos. Journ.

Progress of Physical Science.

An account of a series of daily Observations, made by ANDREW CROSSE, Esq., *of Broomfield, near Taunton, with a Sustaining Voltaic Battery, to ascertain the increase or diminution of the power of the same, as corresponding with the increase or diminution of the temperature of the atmosphere, during a part of the last winter, and commenced previously to the very severe frost which afterwards took place. Also a few remarks on the agency of heat in electro-crystallization.* Read June 19th, 1838.*

For upwards of two years past, I have found it convenient, in the formation of crystalline and other matters, by the electric agency, to make use of porous earthen pots, of the same nature as garden pots; but without an aperture in the bottom. One of these being filled with a compound fluid, A and B, and being plunged in a basin filled with another compound fluid, C and D; A of the one fluid having a greater chemical affinity (as it is called) to C of the other fluid, than it has to B, with which it is united, and also B to D, so that by the admixture of the two fluids, double decomposition would take place; an electric current being passed, by means of primary conductors proceeding from the poles of a voltaic battery in constant action from one fluid to the other, through the pores of the pot employed, a slow union of A and C, or B and D, or both, takes place, either at the positive or negative pole, or on the inside or outside, or *within the substance* of the pot itself; or in more than one, or in all of these, according to the *nature* and *temperature* of the fluids employed, the *intensity* or *quantity* of the electric current, the thickness of the pots, and the presence or *absence of light*, which last is in most cases of greater or less importance, and in some absolutely essential. The result of this union is common to the production of regularly or irregularly formed crystalline matters, more or less firmly adhering to substances upon which, or within which, they are formed. I have used these pots in hundreds of experiments, in an infinite variety of applications, and with considerable success. I have likewise used them more or less extensively in the place of bladder in sustaining voltaic batteries, for which purpose they are admirably suited. They have, however, one defect. If,

* From the Transactions of the London Electrical Society.

while sulphate of copper is used for the negative cells, a neutral salt be employed for the positive, in the course of time crystallizations are formed within the substances of the earthenware which separates the two fluids, and the pots are cracked in all sorts of forms—sometimes longitudinally; sometimes laterally; sometimes in concentric layers; the outer or inner portions scaling off like the bark of a tree; and sometimes in small angular or circular fragments, which start off with a slight explosion, so that after some months' action, the earthen vessel is spotted over with deep indentions, either external or internal, or both. It is therefore safer and better, on all accounts, to avoid the use of neutral salts in the positive cells, which I commonly fill with simple water, when I wish to keep up a uniform action for a considerable time, and when I employ these pots merely in the place of bladder.

The following observations were made in a room exposed to the light, with a southern aspect, and situated about 800 feet above the level of the sea—

Dec. 22, 1837. 10 P. M. I set in action a small sustaining battery composed of twelve two-inch square arcs of zinc and copper, (the zinc not amalgamated) in small porous pots and glass basins; each zinc plate resting on a small piece of zinc, placed in a glass basin filled with common water; and each copper plate resting on a larger piece of copper placed within a pot which stood in the middle of the next glass basin, and which contained three ounces of sulphate of copper and water. It is a simple and economical mode of increasing the surface of the metals employed, to cause the pairs of plates to rest respectively on larger masses of the same metals, by which means small plates may be made to act in some degree with the power of large ones, and which partially saves the expense and trouble of casting. A Faraday's voltameter being filled with common pond or river water, was connected with the poles of the battery, and emptied of its gas each night at 10 o'clock, and replaced in its former situation. A thermometer was likewise suspended above the battery, so that its bulb was immersed in one of the glass basins of water. This thermometer was examined at different intervals during the day and night, and the degrees of temperature carefully noted. It is obvious that by this arrangement only a portion of the electric fluid excited could possibly pass through the voltameter, as no acid was added to the water with which it was filled. For this I had reasons which I shall not here dwell upon.

The observations were continued for the space of one month, or twenty-eight days, during which time neither water nor sulphate of copper was added to the cells of the battery, in consequence of which a good deal of the fluid had evaporated at the month's end. When the voltameter was first applied, a very small stream of the combined gases was extricated, but in the course of some hours it increased, and at the end of twenty-four hours 42-20ths or degrees of gas were evolved. It will be seen by inspecting the journal attached, that the battery did not arrive at its maximum of power till the third day from the commencement of its action. This was occasioned by the resistance of the earthen pot to the electric current, a thicker or a thinner pot affording a greater or a less resistance. It will likewise be seen that in general there was a more or less regular decrease of power, which seemed to be at the rate, as near as one may judge, of from one to two degrees of gas in twenty-four hours, supposing the temperature to remain the same; but that in general the power increased or diminished with the increase or diminution of temperature. Thus in the first week, as long as the thermom-

eter stood at about 50, the diminution of gas was from one to two degrees in each day; but on the last day of the year, when the thermometer had sunk from 50.5 to 47, the quantity of gas obtained was lessened from 61 to 57.5 degrees: also between the 6th and 7th of January, with a diminution of temperature of from 42.5 of the thermometer to 39, there was a diminution of gas of from 51 to 45 degrees. This is what one might, more or less, have expected; but I know not how an increase, and a somewhat considerable one, of the power of the battery could take place under a *diminution* of temperature. Thus, on January 13th, with the thermometer at 32, forty-five degrees of gas were produced; when, on the preceding day, with the thermometer at 36, only 42 degrees of gas were liberated. Again, on the 17th of January, 47 degrees of gas were produced, with the thermometer at 34, when on the preceding day there were only forty-one degrees of gas with the thermometer at 33. The one degree's increase of heat bears no proportion to the six degrees' increase of gas. Again, on the last day of the journal, with the thermometer at 32, there were 4 degrees of gas less than the preceding day with the thermometer at 31. This requires sifting and close examination. It may be observed that the degrees of gas produced on the last day, with the thermometer at 32, and with ice in all the cells, were exactly the same as on the first day with the thermometer at 50. It may also be noted that the total quantity of gas obtained in the fourth week was only 4.5 degrees less than that which was obtained in the third week, notwithstanding the natural diminution of power in the battery, the increased loss by evaporation of fluids, and the five degrees diminution of temperatures. I was prevented from prolonging these observations by the freezing of the water in all the cells. I may here observe, that I had, previously to these experiments, as I have since, tried the effects of heat in combination with voltaic electricity in the formation of crystals, and that I have exposed various solutions under different conditions to the electric action, such solutions having been kept, as nearly as possible, at the boiling point, from one to six weeks, the apparatus being plunged in sand baths, with fires kept up day and night, without a moment's intermission, and the solutions being constantly replaced as they evaporated. In sixteen of these experiments which were carried on at the same time, the evaporation was so great that it exceeded seven gallons in every twenty-four hours. I am not prepared at present to give a succinct account of the different results of these operations, but shall state generally the following conclusions.

1. A piece of yellow sulphuret of copper was exposed to the electric action, in sulphate of copper at the negative pole, *in the cold solution*, and found after a given time to gain a certain weight, the same being my friend Mr. Fox's experiment.

2. A similar piece of the same was exposed, exactly under the same circumstances, *in the hot solution*, to the same electric power, and found to gain *thirty-one times* the weight of the preceding, within the same time. Such additional weight in both cases mostly consisted of metallic crystallized copper and red oxide of copper on the surface of each.

3. Although the solutions in which the latter formation took place, were kept, as constantly as possible, at the boiling temperature, the crystals were generally of the most regular form, with their angles and facets quite as perfect as those of a natural formation.

4. In the production of crystallized copper and red oxide of copper, I found that with a single pair of plates plunged in boiling solutions, the increase of crystallized matter averaged 60 *grains in each day*, or one ounce

troy in every eight days; and that, consequently, even tons weight of crystallized copper and red oxide of copper may be formed in a comparatively very short space of time by an increase of electric power, and the quantity of solutions employed. The sizes of my plates were various, generally about two inches square.

5. By covering large plates of zinc with plaster of Paris, unconnected with any copper plates, and laying them horizontally in large vessels filled with sulphate of copper, kept boiling, and well supplied with a fresh solution as the evaporation went on; the most perfect octohedral crystals of metallic copper and red oxide of copper, were formed to the amount of some ounces in weight in less than ten days. These crystals were fully equal, in all respects, to those formed by nature.

6. The same effects took place in the cold solution, but in an infinitely inferior degree. In this way I have formed crystallized copper, silver, and lead, upon a zinc ingot.

7. In breaking the thick earthen pans, in which some of these formations have taken place, crystals of various sorts are found within their substance. Also veins of metallic copper crossing them in various directions, very similar to what are termed the leaders to a metallic lode. Under some circumstances, perfectly insulated crystals of various sorts, not in connexion with either pole, or with any metallic substance, are formed in abundance. This I have frequently observed, but in much less quantity, to have taken place in the cold solution during the last two years. The above is a correct but rude sketch of some of the general results which I have met with in the combination of heat and electricity.

Query. May it not be possible to apply the combined action of a boiling heat and continued electricity, to the extraction of metals from their ores in a pure state, and with less trouble and expense than the plans now adopted?

London, June 18*th*, 1838.

Extract from the Journal referred to in the preceding Paper.

Days of the week.	Date.	Of Gas Degre's	Therm.	Days of the week	Date.	Of Gas Degre's	Therm.
	1837.				1838.		
Saturday	Dec. 23	42	50	Friday	Jan. 5	52	44
Sunday	24	64	50	Saturday	6	51	42½
Monday	25	69	50	Sunday	7	45	39
Tuesday	26	67½	50	Monday	8	43	37
Wednesday	27	65½	50	Tuesday	9	41	34
Thursday	28	64	50	Wednesday	10	44½	35
Friday	29	62	51	Thursday	11	44	34
Saturday	30	61	50½	Friday	12	42	36
Sunday	31	57½	47	Saturday	13	45	32
				Sunday	14	42	30½
	1838.			Monday	15	43	33
Monday	Jan. 1	56	47½	Tuesday	16	41	33
Tuesday	2	55½	46	Wednesday	17	47	34
Wednesday	3	54	44	Thursday	18	46	31
Thursday	4	52	42	Friday	19	42	32

Gas obtained.		*Average Temperature.*	
1st week . . .	434°	1st week a little above .	50°
2d do. . . .	388°	2d do. not quite .	46°
3d do. . . .	310½°	3d do. not quite .	37°
4th do. . . .	306°	4th do. a little above .	32°

Annals Electr.

The Barometer in the West Indies.

The following remarks on the barometer result from observations during the last two years, by Mr. J. C. Lees, Chief Justice of Nassau.

The range of the mercury in the barometer (except in storms) is greater in the winter than in the summer months: in the West Indies it neither rises nor falls to any thing like the extent to which it does in Europe, but the fluctuations, though small, are equally to be depended on.

Rain in this climate has but little effect on the barometer, which appears to be operated upon principally by the wind, rising or falling according to the direction from whence it blows. Thus the barometer will be much higher with winds from north to east, accompanied by rain, than when they blow from south to north-west, without rain.

The barometer rises highest when the wind is north-east, and falls lowest when it is north-west.

If during the winter months, say from the beginning of November to the end of March, the wind is steady at north-east, the barometer will stand at about 30 to 30.1 and 30.2; if then the weather becomes squally, and the barometer *rises* much, (say one-tenth of an inch more,) it indicates, as far as I can judge from three instances, a gale or very stiff breeze from the same quarter; this is remarkable, for in all other cases of gales the barometer falls. If with the wind at north-east the mercury falls, the wind will become more easterly; if it continues to fall, it will go round to the south-east, south, and so on to the north-west, which will be its lowest point; in ordinary north-westers about 29.9: but instead of sinking thus gradually, if it falls much, and suddenly, with the wind at north-east, or at any intermediate point from that to south, the probability is, there will be a sudden lull, and the wind will fly round at once to the north-west. If, however, after the mercury has been gradually falling, and at any of these intermediate points it rises again, the wind will, in that case, back to the east or north-east, and will continue there until the mercury has again fallen. When the wind is at north-west, if the mercury continues low, the probability is that it will continue for some time at that point; but if it rises, it is a certain indication that the wind will go to the northward, and continue to rise to the north-east; but if it falls with the wind at north, it will back again to the north-west; if the rise with the wind at north-west is much and rapid, the wind will not remain at north, but will go at once to the north-east.

During the summer months, the winds vary from north-east to south, the prevailing ones being between east and south; the barometer will, therefore, be found to fluctuate between about one-tenth of an inch above, to one-tenth below thirty inches, being highest, as before stated, on the approach, and during the continuance, of north-east winds; and lowest during, or previous to, southerly ones; but there is frequently a very light south wind in the mornings and evenings, extending but a small distance from the shore, which

I take to be of the nature of the land wind of the larger islands, and this wind does not seem to affect the barometer.

When during the hurricane months, the barometer falls much and rapidly, preparations ought to be made for bad weather. Suppose, for instance, standing at 30.2, it were to fall rapidly as low as 29.8, this ought to awaken suspicion; but if it were to fall one or two tenths more, there would be almost a certainty that a heavy gale would in a very short period follow; this fall of the barometer might only be an hour, or half an hour, before the hurricane, but a great deal might be done for the security of vessels or houses in that time.

The barometer, however, gave warning of bad weather several hours previous to the destructive gale of the 27th of October last. The 25th had been cloudy and squally, and at 9 o'clock at night, the barometer fell to 29.72. Next morning, the weather had become clear, but the mercury only rose five-hundredths; at noon, the sky was again overcast, the wind began to freshen from the south-east, and the barometer began again to fall. At 8 o'clock P. M. it was 29.7; that night the gale came on from E. S. E., and continued to blow till next morning about 7 o'clock, when it gradually ceased, and the gale was apparently at an end. But the mercury, which had continued to fall all night, and then stood at 28.87, sank, with fearful rapidity, to 28.5. I had a boat moored in the harbour, but not very securely; when, therefore, I observed the fall of the barometer on the day previous to the gale, I had her better secured, which saved her from the effect of the S.E. gale during the night. When the gale was apparently at an end next morning, I was aware, from the still greater fall of the mercury, that it would soon blow harder than ever. I therefore had the boat, as quickly as possible, hauled up, which saved her from certain destruction, for, as will be remembered, in about an hour afterwards, the gale recommenced with tremendous fury from the north-west. About ten o'clock the mercury began again to rise, and about three hours afterwards the gale began to abate. At 9 P. M. it stood at 29.72, and from that time it continued gradually to rise, as did the gale to moderate. I mention the trifling circumstance of the boat merely as an argument that property of more value might, equally as well, have been saved.

I have already said, that these observations are the result of only about two years' experience, a period too short to afford data for any certain conclusion on such subjects; it is very possible that circumstances may expand or condense the atmosphere, so as to occasion a rise or fall of the barometer, independently of the changes of the wind, or the approach of a gale: or, on the other hand, that a gale might occur without a previous warning from the instrument. I can only, therefore, advise those who have a barometer, on the one hand never to despise its indications of a storm, because the weather appears fine; on the other never to neglect the precautions which an appearance of bad weather would suggest, merely because the barometer had not fallen; it would be better to make unnecessary preparations ever so many times, than to lose valuable property once for the want of them.

Nassau, 12th July, 1838. Naut. Mag.

Aerolites.

The following interesting account of one of these extraordinary phenom-

ena of nature having recently fallen at the Cape of Good Hope, is an extract of a letter from a gentleman residing there, on whose authority the strictest reliance may be placed.

24th Nov. 1838.

"I have taken the liberty to transmit, under your charge, for Sir John Herschel, the accompanying aerolite, or rather a portion of an enormous aerolite, that exploded in the department called the Cold Bokkeveld, about 112 miles N.N.E. of this place, on the morning of the 13th of October, and which, for magnitude, ranks with the largest on record of undoubted authority.

"Judge Menzies, returning from circuit, saw it traversing the atmosphere about 60 miles from the estate where it exploded, with a report equal to the discharge of some pieces of heavy artillery, to the great astonishment of the inhabitants, one of whom had a narrow escape from being destroyed by it.

"I am making strong efforts to secure a piece, said to have made a hole in the ground that would admit a dining table! This may be exaggerated. A man declares the hole is three feet in diameter—also to collect information regarding its velocity—course—altitude, &c.

Another meteor on Wednesday, at 6h. 37m. P. M. (daylight) passed over us. I was sitting with my back to a window, when I was suddenly started by the image of the window frame on the opposite wall, as if the noonday sun was shining through it; at the same instant another person sprang up who was sitting with her face to the window, and saw a body as large as a full moon, descending, and which fell in a S.E. direction from us, at the distance of less than half a mile. There was no noise or explosion.

Two of us immediately started off in the line, but could not discover any thing upon the ground.

It is rather curious that these phenomena should generally happen between September and the latter part of December, which favours the hypothesis of the earth, at the latter part of the year, approaching the orbit of a mass of them circulating round the sun.

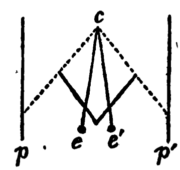
There is a letter from the clergyman at the Bokkeveld, describing the explosion, enclosed to Sir John, with whatever other good authority I could pick up.

Ibid.

On Binocular Vision; and on the Stereoscope, an instrument for illustrating its Phenomena. By Prof. Wheatstone.

Prof. Wheatstone stated, that, at the last meeting of the Royal Society, he had presented the first of a series of papers on the phenomena of vision, in the investigation of which subject he had been for some years engaged. He did not, he said, on the present occasion, intend to enter on the consideration of any of the views and conclusions of that paper, for they related rather to mental, than to physical, philosophy, and they would probably appear in the forthcoming volume of the Philosophical Transactions—he proposed merely to state so much as would enable him to explain the experiments which the apparatus on the table was intended to exhibit. This apparatus he called a Stereoscope, from its property of presenting to the mind the perfect resemblances of solid objects. To understand the principles on which it was constructed, he explained the circumstances which enable us to distinguish an object in relief from its representation on a

plane surface; he showed that when a solid object, a cube for instance, was placed at a short distance before the eyes, its projections on the two retinæ form two dissimilar pictures, which in some cases are so different that even the eye of an artist would with difficulty recognize them as representations of the same object; notwithstanding this dissimilarity between the two pictures, the object is seen single; and hence it is evident that the mind perceives the object in relief, in consequence of the simultaneous perception of the two monocular pictures. He next showed, that if the object were thus drawn, first as it appears to the right eye, and then as it appears to the left eye, and those two pictures be presented one to each retina, in such manner that they fall on the same parts as the projections from the object itself would, the mind perceives a form in relief, which is the perfect counterpart of the object from which the drawings have been taken: the illusion is so perfect that no effort of the imagination can induce the observer to suppose it to be a picture on a plane surface. Prof. Wheatstone described various modes by which the two monocular pictures might be made to fall on similar parts of the two retinæ; but he gave the preference to a method which we will endeavour to explain by means of a diagram.



e e′ are the two eyes of the observer placed before two plane mirrors, inclined to each other at an angle of 90°; the axes of the eyes converge to a point *c*; the pictures *p*, *p′*, are so placed on sliding panels, that their reflected images may be adjusted to appear at the place of convergence of the optic axis; it is obvious, then, that the pictures on the retinæ will be precisely the same as if they proceeded from a real object placed at *c*. In this manner may solid geometrical forms, crystals, flowers, busts, architectural models, &c. be represented with perfect fidelity, as if the objects themselves were before the eyes. The law of visible direction, which is universally true for all cases of monocular vision, may, Prof. Wheatstone stated, be extended to binocular vision, by the following rule: that every point of an object of three dimensions is seen at the intersection of the two lines of visible direction, in which that point is seen by each eye singly.

Sir D. Brewster was afraid that the members could scarcely judge, from the very brief and modest account given of this principle, and the instrument devised for illustrating it, by Prof. Wheatstone, of its extreme beauty and generality. He considered it as one of the most valuable optical papers which had been presented to the Section. He observed, that, when taken in conjunction with the law of visible direction in monocular vision, (or vision with one eye) it explains all those phenomena of vision by which philosophers had been so long perplexed; and that vision in three dimensions, which M. Lehot, a French author, had attempted to account for by a very unscientific theory, had received a complete explanation from Mr. Wheatstone's researches.—Sir John Herschel characterized Mr. Wheatstone's discovery as one of the most curious and beautiful for its simplicity, in the entire range of experimental optics. Br't. Assoc—Athenaeum.

Cause of Animal Heat.

Dr. J. M. Winn, of Truro, Cornwall, has ascertained that the elastic coat of an artery, when stretched, will give out heat, in the same manner as a piece of caoutchouc. Upon making an experiment with part of the aorta of

a bullock, he felt much gratification in being able to verify his previous conjecture. The experiment was performed in the following manner. Having cut off a circular portion of the descending arch of the aorta, about an inch in length, he laid it open and carefully dissected out the elastic coat, and taking hold of it by each extremity, pulled it to and fro with a continuous jerking motion, (in imitation of the systole and diastole of the artery) for the space of about a minute, when placing it upon the bulb of a thermometer, he had the satisfaction to find, that after it had remained two minutes the mercury had risen as many degrees. On removing the thermometer, the heat immediately began to diminish. To be certain that the heat did not arise from any other source than the one in question, he took the precaution of covering his fingers with a double layer of flannel, to prevent the communication of heat from the body: he also covered his mouth with a handkerchief, to guard against the warm breath affecting the thermometer, whilst watching the progress of the thermometer. It may likewise be stated that the experiment was performed in a room without a fire, the temperature of the air at the time being 55°. There were several difficulties to contend with during the investigation, and it was not until after repeated trials that the experiment succeeded to his satisfaction. The chief impediment, he thinks, must have been owing to the moisture of the artery, which, by its evaporation, must have had a constant tendency to carry off the heat. Having, however, performed the experiment twice consecutively in the same satisfactory manner, he thinks there can be but little doubt entertained as to its conclusiveness. His attention was often arrested, whilst conducting the experiments, by the striking mechanical analogies between caoutchouc and the elastic coat of arteries. Like the latter, it could be elongated to twice its ordinary length, and, on withdrawing the tension, would return to its usual dimension with considerable force and a snapping noise. He was also surprised to find, on slightly drying it, that it would erase black lead pencil marks from paper without leaving a stain. This latter circumstance is perhaps of trifling importance; it serves, however, to show that strong mechanical resemblance may exist between bodies widely differing in their chemical properties.

The doctor regards this experiment, with some plausibility, as accounting satisfactorily for that portion of animal heat which cannot be fairly ascribed to the chemical changes which take place in the lungs. Edin. Philos. Journ.

Note of the Character and Direction of the Electric Force of the Gymnotus. By Michael Faraday, Esq., D. C. L., F. R. S., &c.

The author first briefly refers to what has been done by others in establishing the identity of the peculiar power in the gymnotus and torpedo with ordinary electricity, and then in reference to the intended conveyance to this country of gymnoti from abroad, gives the instructions which he himself had received from Baron Humboldt for that purpose. A living gymnotus, now in the possession of the proprietors of the Gallery of Science, in Adelaide street, was placed for a time at the disposal of the author, for the purpose of research, upon which he proceeded with suitable apparatus to compare its power with ordinary and voltaic electricity, and to obtain the direction of the force. Without removing it from the water, he was able to obtain not only the results procured by others, but the other electrical

phenomena required, so as to leave no gap or deficiency in the evidence of identity. The shock, in very varied circumstances of position, was procured; the galvanometer affected; magnets were made; a wire was heated; polar chemical decomposition was effected, and the spark obtained. By comparative experiments made with the animal and a powerful Leyden battery, it was concluded that the quantity of force in each shock of the former was very great. It was also ascertained by all the tests capable of bearing on the point, that the current of electricity was, in every case, from the anterior parts of the animal through the water, or surrounding conductors, to the posterior parts. The author then proceeds to express his hope that by means of these organs and the similar parts of the torpedo, a relation as to *action* and *reaction* of the electric and nervous powers may be established experimentally; and he briefly describes the form of experiment which seems likely to yield positive results of this kind. Ibid.

Progress of Civil Engineering.

Engineering Duties of the Birmingham Railway Officers.

The labours of the engineers, it is almost needless to state, commenced long before the ground was broken. In fact, many of them were employed in getting assents to our bill, from the landowners, who have shown themselves so wise in their generation. Then came the various surveys and levellings required for fixing the line; then the designing and drawing of bridges and other works in detail, in order that approximate estimates of costs might be laid before Parliament. When the period arrived for executing the works, it was necessary to calculate the time which those of the greatest magnitude would be likely to occupy, so that they might be let to the contractors in such an order, that the whole might be simultaneously completed, as far as possible, with reference to the successive openings of portions of the whole line, which was desirable, not only as a measure of pecuniary interest, but to get the road in good repair, and to drill every one into his particular duty. The order of letting the contracts having been decided, assistant and sub-assistant engineers were appointed, as required, upon the general principle of dividing the whole line into four districts, and each district into three lengths, so as to place about ten miles under the immediate superintendence of one sub-assistant engineer; thus each assistant engineer had three sub-assistants, being all subordinate to one engineer in chief.

When any particular portion of the works was to be prepared for letting, the sub-assistant engineer, under the direction of his superior, had to revise all the parliamentary surveys and levels with the utmost care, and draw to a large scale very accurate plans and sections of the land, in order that the quantity of excavations and embankments might be obtained as nearly as possible. It was also necessary to make detailed plans and working drawings, elevations, and sections of every bridge and culvert which carried a road or stream across the railway, or which carried the railway over a road or stream. These, being roughly sketched by the engineer on the spot, were sent to the chief office, to be fairly drawn out with full details, and upon a

uniform system laid down by the principal engineer; the object being to put them in such a shape that parties wishing to tender for any of the contracts might clearly understand the nature of the works, and make accurate estimates from the drawings without difficulty. The limits of each contract were defined with reference to the most convenient execution of the works, regard being had to the disposition of the earth works, so that each contractor might make his embankments with the materials yielded by his excavations, as far as it was practicable; care being taken that the aggregate amount of the contract should not exceed the means of the generality of persons in the habit of tendering for such works.

A contract of 100,000*l.* was thought a very responsible undertaking; and the experience of the London and Birmingham Railway has shown that those amounting to, or exceeding, that sum, have called for extraordinary exertions. Of these there have been seven upon the whole line; four were very soon relinquished by the parties originally contracting for them, and the remaining three executed with great difficulty.

The drawings being completed, and the limits of the contracts fixed, detailed specifications were drawn up, under the engineer in chief's superintendence; the whole was then submitted to the inspection of parties willing to tender for the works, who, on an appointed day, delivered in their respective estimates; and the lowest tender was generally, but not invariably, accepted,—regard being always had to the character and means of the parties. The whole of these extensive and important works were let at prices which were under the estimate of the engineer in chief.

The original contract drawings were signed by the engineer in chief and the contractor, and preserved as documents. Three copies of each, however, had to be made out—one for the use of the committee, one for the engineer in chief, and one for the assistant engineer.

When it is borne in mind that the engineering works of the whole railway, in accordance with the above system, were divided into thirty separate divisions, each requiring its own set of drawings, estimates, and specifications, and that all these works, with two unimportant exceptions, were let to various contractors, between May, 1834, and October, 1835, it will be perceived that an extensive and efficient drawing establishment must have been kept at work. Speaking in round numbers, we must say that for eighteen months, not less than thirty drawings per week, each requiring two days' work from one pair of hands, were turned out from the engineer in chief's office.—*Lecount's History of the Birmingham Railway.*

Lond. Mech. Mag.

Plan for Detecting the Displacement of Rails, and of Preventing Accidents on Railways.

Captain Smith, R. N., suggests the following plans for giving additional safety to railway traveling.—For the purpose of detecting the displacement of a rail on any line of road, the policemen stationed for its protection should be desired to pace from one station to the other, once or twice during their watch, drawing after them a *staff along the edge of the rail;* the staff being fitted with a hook on the end, so formed as to *fit the edge of the rail.* It appears to me, that by this simple and unexpensive plan, the slightest derangement would be detected with much greater certainty than if left

to the vision of the men, though aided by a lantern, especially during heavy rain or snow.

The application of this detector would also serve to discover any thing that might be thrown on a rail by design, or driven on it by a powerful gust of wind, &c.

The application of the plan would ensure the patrolling of the line of road from one end to the other, the men being desired to pass each other a few yards before they return to their station box, which they should do by the other rail, drawing the staff or detector after them, as on the first. The men might be required to exchange their staff, (which should be numbered) as a proof they had communicated with each other on their beat.

I ventured to suggest, some time since, that a gong might be used to advantage, if attached to the *last* carriage in each train, to be struck for the purpose of warning a train that might be expected to overtake one that was detained on the road by accident or otherwise.*

I am aware that powerful lights are used for these purposes; but as fogs are occasionally exceedingly dense, and people's eyes are not always open, I feel assured that the sound of a powerful gong would be found much more useful in peculiar cases—and it might also be used as a means of calling the attention of the engineer, should the guard at the opposite end of a train require to do so, in the event of a separation in the train, or other casualty.

It is also suggested for consideration, that in order to enable the trains to run without loss of time when the rails are slippery, that the engine should be fitted with a box or compartment to contain sand, from which two pipes should lead before the first wheels, and immediately over the rails, to be arranged so that the engineer could with ease cause sand to be sprinkled lightly on the rails, whenever he found them too slippery to proceed as fast as he wished. The sand to escape on the principle by which some seeds are sown. The first or the last carriage might brush the sand off (if thought requisite) as it followed the engine, to prevent the rails being unnecessarily worn by the increased friction. [The use of sand, &c. has been already suggested by Col. Maceroni.] Ibid.

Experiments on the Power of Men. By Joshua Field, V. P. Inst. C. E., F. R. S.

In this paper are recorded the results of some experiments made to ascertain the working power of men with winches, as applied to cranes. The experiments were undertaken with a view of ascertaining the effect men can produce working at machines or cranes for short periods, as compared with the effect which they produce working continuously.

The apparatus, a crane of rough construction in ordinary use, and not prepared in any manner for the experiments, consisted of two wheels, of 92 and 41 cogs, and two pinions, of 11 and 10 cogs; the diameter of the barrel, measuring to the centre of the chain, was 11¾ inches; and the diameter of the handle 36 inches. The ratio of the weight to the power on this combination is 105 to 1.

* An accident occasioning the loss of *lives*, is just announced in the papers as having occurred in America, in consequence of a dense fog.

The weight was raised in all cases through 16½ feet, and so proportioned in the different experiments, as to give a resistance against the hands of the men of 10, 15, 20, 25, 30, and 35 lbs., *plus* the friction of the apparatus.

*   *   *   *   *

In order to compare these experiments with each other, these results must be reduced to a common standard of comparison, and it is very convenient to express the results of such experiments by the pounds raised one foot high in one minute, this being the method of estimating horses' power. The number is in each case obtained in the following manner. I will take the first experiment.

Here 1,050 lbs. was raised 16½ feet high in 90 seconds; this is equivalent to (1,050 × 16.5) = 17,325 lbs. raised one foot high in 90 seconds, which is equivalent to (17,325 ÷ 1.5=11,550 lbs. raised one foot high in one minute. In this case, then, the man's power = 11,550.

The same calculations being pursued in the other cases, give the numbers constituting the last column of the following table:—

No. of Experiment.	Statical resistance at handle.	Weight raised.	Time in seconds.	Time in minutes.	Remarks.	Man's power.
I.	10	1050	90	1.5	Easily, by a stout Englishman, . . .	11550
II.	15	1575	135	2.25	Tolerably easily, by the same man . . .	11505
III.	20	2100	120	2	Not easily, by a sturdy Irishman . . .	17325
IV.	25	2625	150	2.5	With difficulty, by a stout Englishman .	17329
V.	30	3150	150	2.5	With difficulty by a London man . .	20790
VI.	35	3675	132	2.2	With the utmost difficulty by a tall Irishman	27562
VII.	..	..	150	2.5	With the utmost difficulty, by a London man, same as Experiment V. . .	24255
VIII.	..	..	170	2.83	With extreme labour, by a tall Irishman .	21427
IX.	..	..	180	3	With very great exertion, by a sturdy Irishman, same as Experiment III. . .	20212
X.	..	..	243	4.05	With the utmost exertions, by a Welshman	15134
XI.	.	..		. . .	Given up, at this time, by an Irishman .	....

We may consider experiment IV. as giving a near approximation to the maximum power of a man for two minutes and a half; for in all the succeeding experiments the man was so exhausted as to be unable to let down the weight. The greatest effect produced was that in experiment VI. This, when the friction of the machine is taken into the account, is fully equal to a horse's power, or 33,000 lbs. raised one foot high in one minute. Thus, it appears, that a very powerful man, exerting himself to the utmost for two minutes, comes up to the constant power of a horse, that is, the power which a horse can exert for eight hours per day.—*Trans. Inst. C. E.* Ibid.

We should be glad to see the experiments of the above table extended to a complete dozen, by the trial of a good Yankee or a big boned Kentuckian.

G.

Oxford Street Experimental Pavement.

The importance of ascertaining the best species of pavement for the car-

riage roads of the metropolis is some excuse for the confusion, accompanied by the smoke and offensive odours from the caldrons, which have prevailed at the east end of Oxford street for the last two months. The inhabitants have, however, been great sufferers thereby; but we now congratulate them, that, at last, all the ground is assigned and set out for the different varieties, while many of them are completed, and the rest are in progress. Commencing at Charles street are the *asphaltum blocks of Robinson*, one half laid straight, the other diagonally. This is followed by *granite pavement*, nine inches deep, jointed with Claridge's asphaltum; then is to succeed a granite pavement of stones, only four and a half inches deep, also to be joined with the same substance, Mr. Claridge being of opinion, and desirous of proving, that his cement is sufficiently strong to bind even these shallow stones into one solid mass. To this succeeds the *Bastenne Company's* portion; the blocks in this part are in the form of bricks, but somewhat larger; they have been laid both ways, straight and diagonally. Next follows the *granite pavement*, laid by the parish, which is undoubtedly one of the finest specimens of work of its kind to be found in London. It consists of three parts:—1. Stones laid in the ordinary way, on a well formed bed of concrete. 2. Similar stones laid diagonally on a bed of the same material; the joints of both these portions are filled with a grouting of lime, sand, &c. 3. Stones laid in the usual manner, but on the earth, without any official bed, and the joints are filled in with fine gravel. The whole of this work has a good curved surface, and the regular thickness of the stones has evidently been carefully attended to. The next experiment, going towards Tottenham court road, is what is called the *Scotch asphaltum granite*, (said to be a patented article.) This composition has the appearance of stone, and the blocks are about six inches thick, nine inches broad, and eighteen inches long on one face, while the other is only thirteen inches long. In laying them, (which is done with Parker's cement) every alternate block is reversed, so that every second block lies solid on its base, or longest face, while the others fit in between them as keystones, and when joined, each may be said to support the other. The next division is the *wood pavement*, composed of blocks of fine timber, Kyanized; they are of a hexagonal form, seven inches diameter, and fifteen inches deep, part is laid on a bed of one and a half inch planks. Then follows the *Val de Travers asphalte*, which will occupy the remaining portion of the street devoted to experimental pavement. This last article consists of blocks, about ten inches square and five inches thick, formed of a bitumen thickly studded by broken pieces of granite; so that, when laid, it may be looked upon as a sort of macadamized road, where, in lieu of earth, for filling the interstices between the broken granite, and making the whole of a solid mass, a strong binding composition has been employed.—*C. E. & Arc. Journ.* Ibid.

Supplying St. Pancras with Water from Artesian Wells.

We have been much surprised to see by the newspapers that this subject has been seriously thought of, and discussed in meetings, at which some persons were present eminent for scientific knowledge. We thought it had been generally known that the sources which supply the London basin, ample as they are, are still limited. As a practical proof of this, it is only necessary to mention that the two great breweries which draw their supplies

from wells which penetrate to the chalk, the one on the Middlesex, and the other on the Surrey side of the river, cannot both pump on the same day, and, by agreement, pump on different days. If a part of the Thames water above Richmond, where it is tolerably pure, could, by means of a deep shaft, be made to run into the basin, then, no doubt, the whole of London might be supplied from it, cheaper than is now done by surface pipes. But, supposing this mode to be adopted, it would only prove sufficient for a century or two; for such would be the quantity of sand and mud carried down by the water of the Thames, that, unless it were filtered before it entered the shaft, it would, in time, solidify the under stratum. Among all the plans that have been devised for supplying London with water, we have no doubt whatever that the present mode, by surface pipes, is the best, provided the water be drawn from pure sources. By being brought in in pipes covered by earth, the water is delivered at a lower temperature in summer, and a higher temperature in winter, and free from all those impurities to which an open water course is liable: witness, for example, the New River. How to induce the public companies to supply water at moderate rates, is a different question. Perhaps the real object of the St. Pancras meeting was to hold the Artesian system *in terrorem* over the advocates of the surface system, in order to keep the water companies within bounds.—*Mr. Loudon—Arch. Mag.*

Ibid.

Nuremberg Railway.

The third anniversary of the opening of the railway from Nuremberg to Fürth, has just been celebrated. Since the 7th of December, 1835, no less than 1,357,285 passengers have been conveyed on this railway, though the population of both towns between which it runs does not exceed 60,000. This makes seven journeys each year for each inhabitant,—an astonishing result. During those three years no life has been lost on the railway, no serious accident of any kind has occurred, and the railway has received no material injury.

Ibid.

Austrian Railroads.

The rails in the Austrian railroads are now made of Iron from Styria, which are said to be found more durable than those supplied from England.

Ibid.

Mechanics' Register.

Submarine Volcano.

On the 25th of last November, the captain and passengers of the brig Cæsar, from Havre, on passing the bank of the Bahama, saw an enormous fire, which increased till it had tinged the whole of the sky, and part of the horizon. It was kept in sight for four hours, and could only be accounted for as proceeding from a submarine volcano. On the 3d of January, the captain of the Sylphide, also from Havre, being on the same spot, found the sea disturbed, and whitish in colour, which he attributed to the same cause. To these notices, conveyed to the French Academy of Sciences,

M. Moreau de Joannes adds, that on the 30th of the same December, an earthquake took place at Martinique. The shock was violent, and the heat very great.

Naut. Mag.

Joyce's Apparatus for Heating by Steam.

A mode of heating a small greenhouse by steam from a portable apparatus placed within the house, has lately been invented by Mr. Joyce. The apparatus is a copper cylinder, with the fire placed in the centre, the fuel being supplied from the top, and the ashes coming out below, through the grating which admits air to the fire. The fuel is charcoal, and the little smoke which it produces is delivered into the same tube which conveys away the steam. At the further extremity of the steam pipe, the fumes of the charcoal are allowed to escape outside the house, through a tube, which, for ordinary apparatus, need not exceed an inch in diameter. As the steam pipe is placed so as to return all the condensed water to the boiler, the loss of heat by this mode is extremely small, but it will not answer well for any other fuel except charcoal, which is expensive.—*Loudon's Suburban Gardener.*

Lond. Mech. Mag.

Chaplin's Non-elastic Leather Bands.

A method has at length been discovered of manufacturing leather, for machine straps or bands, which is nearly, or quite, free from any tendency to stretch. This is accomplished by the new method of tanning, which lately attracted some notice in the pages of the Mechanics' Magazine, and of which Mr. Chaplin is the inventor. The hide, in its elastic state, before it is tanned, is made into a bag, by sewing the edges together, and filled with tanning liquor, the pressure of which forces it through the pores, so that it comes out on the other side, leaving the tannin which it contained in combination with the hide—the result sought by the tanner. In this way the hide is, of course, completely opened and extended, and kept so during the whole process; so that, when the leather is afterwards subjected to strain or pressure, very little further extension can be obtained.

Ibid.

Great Seal of England.

Her Majesty's new great seal is a most beautiful specimen of art, and reflects the highest credit on the talent, skill, and professional taste of the artist:—Obverse: an equestrian figure of her Majesty, attended by a page. The queen is supposed to be riding in state; over a riding habit she is attired in a large robe, or cloak, and the collar of the order of the garter; in her right hand she carries a sceptre, and on her head is placed a royal tiara or diadem. The attendant page, with his hat in his hand, looks up to the queen, whilst gently restraining the impatient courser, which is richly decorated with plumes and trappings. The inscription, "Victoria, Dei Gratia Britanniarum Regina, Fidei Defensor," is engraved in Gothic letters, and the spaces between the words are filled with heraldic roses.—Reverse: the queen, royally robed and crowned, holding in her right hand the sceptre, and in her left the orb, is seated upon the throne, beneath a rich Gothic canopy; on either side is a figure of Justice and Religion; and in the ex-

ergue are the royal arms and crown; the whole encircled by a wreath or border of oak and roses. Lond. Journ.

On the Expansive Action of Steam in Cornish Engines. *By* W. J. Henwood.

At the commencement of this paper, the author describes, with great detail, the action of the indicator, and the nature of the evidence which it furnishes on the working of an engine. The author then states the results arrived at on applying the indicator to the cylinders of some of the best engines in Cornwall. The peculiar circumstances of each case, as the clothing of the boilers, steam pipes, and the various methods adopted for keepup the temperature of the cylinder, are detailed. The steam cases or jackets of some of the engines, were filled with dense steam from the boilers of others with heated air. The dimensions of the working parts and the loads of the engines, the water and steam in the boilers, the temperatures of the hot well of the condensing water, of the boiler shed, engine house, and external air; the duration of the experiments; the coals consumed, according to weight and measure; the quantity of oil and grease; the number of strokes; the duration of each experiment, and the pressures of the boiler and cylinder are tabulated for the respective engines.

The greatest duty performed by the measured bushel, by 84 lbs. damp, and by 84 lbs. dry, is respectively $86\frac{1}{2}$, $72\frac{1}{2}$, and $77\frac{1}{2}$ millions.

This paper also contains a calculation, as to the expense of performing a given quantity of work, and it appears that, a proper allowance being made for the coal, grease, and oil consumed, there was raised by Huel Towan engine, 1085 tons, and by Binner Downs 1006 tons, one foot high for one farthing. According to this result, the weight of a man ($1\frac{1}{2}$ cwt.) would be raised ten miles for a penny. Ibid.

On the Dry Meter. *By* S. Clegg.

The instrument originally designed for measuring gas, may be applied to other useful purposes, as to register the average pressure of high pressure steam, the average temperature of heated air, or the average of any variable temperature for any period. The principle of action in this instrument, is the evaporation of spirits of wine, which is well known to vary *directly* as the heat. The spirit of wine is contained in a pulse glass, the connecting stem being bent round, so that the two bulbs are brought nearly into contact with each other; the glass revolves about an axis perpendicular to its plane, the axis being so placed, that when the upper glass is filled with the spirit, the centre of gravity should be a little beyond the vertical, through the point of suspension, and, consequently, the upper bulb descends. In the framework of the instrument are two orifices, opening directly on the upper and lower bulbs, but of different areas, the lower orifice being somewhat the larger: through these orifices, currents of gas are passed by means of tubes, the gas having been previously conducted to the under side of a gas burner, so that the gas in its passage may be heated. It is then ascertained by actual experiment, what quantity of heated gas will cause the spirits from the lower globe to be driven into the upper one: this, once ascertained, may be always depended upon. The spirit of wine having ascended from the lower

to the upper globe, the descent of the upper one gives motion to wheel work, whereby the number of these oscillations, and consequently the number of volumes of heated gas which have passed through the tubes, may be registered.

Ibid.

Enormous Plate of Iron.

We were lately shown, in Messrs. Fawcett, Preston & Co.'s yard, two plates of iron, which are said to be the *largest ever made.* They measure 10 feet 7 inches long, 5 feet 1 inch wide, and 7-16ths of an inch thick, and weigh between 7 and 8 cwt. They are intended for the bottom plates of two steam generators, on Mr. Howard's plan, and were made by the Colebrookdale Iron Company, Shropshire; who, we were informed, are the only company in Britain (we may say in the world) that can make plates of this size, or even approaching to it.—*Liverpool Standard.*

Lond. Mech. Mag.

Patent Safety Fuse.

The patent safety fuse, noticed and recommended in this Journal, is now manufactured at Simsbury, Hartford county, Conn. Agents for the sale of it are Curtis & Hand, 16 Commerce street, Philadelphia; Pratt & Keith, South Charles street, Baltimore; G. B. Peake, Richmond, Va.; and W. B. Peake, Fredericksburg, Va.

G.

Easy Receipt to Make Vinegar.

One pound of coarse brown sugar to a quart of water; boil them together, taking off the scum; when that ceases to rise, pour off the liquor; and when it has cooled down to the same temperature as beer in the process of brewing, throw in a piece of hot toasted bread, spread with yeast. In twenty hours put the whole into an iron hooped barrel, placed near a fire; or in summer, where it may have the heat of the sun the greater part of the day. The barrel must not be bunged up, only place a tile, or any thing else that will keep out dust and insects, over the bung hole. In three months, or sometimes less, the vinegar will be clear and fit for use; it should then be bottled off, and the longer it is kept in bottle the better it will be.—*Labourer's Friend.*

Lond. Farm. Mag.

A Transparent Watch.

A watch has been presented to the Academy of Science, at Paris, constructed of very peculiar materials, the parts being principally formed of rock crystal. It was made by M. Rebellier, and is small in size. The internal works are visible; the two teethed wheels which carry the hands are rock crystal, the other wheels of metal, to prevent accidents from the breaking of the springs. All the screws are fixed in crystal, and all the axles turn on rubies. The escapement is of sapphire, the balance wheel of rock crystal, and its springs of gold. The regularity of this watch as a time keeper is attributed, by the maker, to the feeble expansion of the rock crystal in the balance wheel, &c. The execution of the whole shows to what a state of perfection the art of cutting precious stones has been carried in modern times.

Lond. Mech. Mag.

LUNAR OCCULTATIONS FOR PHILADELPHIA, JUNE, 1839.					Angles reckoned to the right or westward round the circle, as seen in an inverting telescope. ☞ For direct vision add 180° ☜	
Day.	H'r.	Min.	Star's name.	Mag.	from Moon's North point.	from Moon's Vertex.
20	7	59	Im. 68 i Virginis	,5,	84°	93°
20	9	13	Em.		203	228
21	11	0	Im. 1617 Baily Virginis	,6,	92	126
21	12	10	Em.		221	264
23	8	50	Im. b Scorpii	5	75	239
23	10	20	Em.		65	248
30	9	59	Im. 45 D Aquarii	6	89	39
30	10	56	Em.		317	271

Meteorological Observations for December, 1838.

Moon.	Days	Therm.		Barometer.		Wind.		Water fallen in rain.	State of the weather, and Remarks.
		Sun rise.	2 P.M.	Sun rise.	2 P.M.	Direction.	Force.		
				Inch's	Inch's			Inches.	
☺	1	29	41	29.83	29.70	W.S.W.			Lightly cloudy—do. do.
	2	36	46	60	60	S.W.W.			Cloudy—do.
	3	24	34	9[illegible]	30.01	W.			Clear—do.
	4	27	32	30.[illegible]5	14	E.			Cloudy—flurry of snow.
	5	33	35	29.90	29.70	W.S.		.05	Drizzle—do.
	6	34	38	56	56	W.			Clear—lightly cloudy.
	7	22	39	70	6[illegible]	W			Clear—cloudy.
☽	8	32	38	50	52	S E W.		.08	Snow—clear.
	9	19	24	30.00	30.06	W.			Clear—do.
	10	14	22	15	15	W.			Clear—cloudy.
	11	29	43	29.95	29.84	N S W.			Cloudy—clear.
	12	31	43	65	80	S.W.W.			Clear—do.
	13	16	28	30.26	30.26	N.S E.			Clear—do.
	14	30	36	05	29.90	N.E.			Cloudy—do.
	15	32	48	29.84	84	W.			Clear—do.
⊗	16	29	28	30.05	30.15	W.N.W.			Cloudy—lightly do.
	17	18	29	10	10	E.		.25	Cloudy—snow
	18	30	42	29.60	29.60	W.			Cloudy—partially do.
	19	32	35	70	75	W.			Partially cloudy—clear.
	20	24	28	80	85	W.			Clear—flying clouds.
	21	28	37	56	53	S.W.W			Cloudy—flying clouds.
	22	32	41	40	40	S.W.W.			Cloudy—do.
☾	23	31	21	40	40	W.			Cloudy—clear.
	24	12	22	30.05	30.0[illegible]	W.			Clear—do.
	25	14	33	00	0[illegible]	W.S.W.			Clear—do.
	26	28	30	29.91	29.40	W.			Cloudy—clear.
	27	17	23	30.05	30.06	N.W.			Clear—do. [night.
	28	11	27	29.25	25	W.S.		.54	Clear—lightly cloudy—snow in
	29	29	28	45	29.70	N.W.			Cloudy—do.
☺	30	8	19	30.[illegible]0	30.60	W.			Clear—do.
	31	10	24	45	45	W.			Clear—do.
	Mean	24.64	33.03	29.85	29.87			0.92	

	Thermometer.		Barometer.
Maximum height during the month.	48. on 15th.	. .	30.60 on 30th.
Minimum " " "	8. 30th.	. . .	29.25 28th.
Mean	28.838	. . . .	29.861

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Physical Science.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Col. Reid's Law of Storms Examined. *By* James P. Espy.

(Concluded from p. 231.)

Col. Reid has copied into his work the documents furnished by Mr. Redfield concerning the storm of August, 1830. This storm, if indeed it was one, and not many, was upwards of 1000 miles long from N.N.E. to S.S.W., and at least five times as long as it was broad on the 17th. This fact, though it seems to have escaped the notice both of Mr. Redfield and Col. Reid, is abundantly proved by the following documents. For it will be seen that the brig Mary had a gale in lat. 27° 55′, lon. 76° 50′, which lasted till the 17th, and that on the same day the storm was felt at several points N.N.E. of the brig Mary, as far as Long Island Sound. And on the 18th, its length appears to be still greater, for it seems to have reached from lat. 28°, lon. 66°, where the wreck of the Julia was seen on that day, to lat. 41° 20′, lon. 66° 25′, where the hurricane was tremendous on the 18th from N.N.E.

Whether this storm traveled side foremost exactly or not, cannot be ascertained by the documents collected. It certainly moved towards the eastward.

It is even doubtful whether it was one continuous storm, or composed of several. Yet it will be seen that it commenced at Wilmington, N. C. four hours sooner than at Charleston, S. C., and at Charleston one hour earlier than at Savannah, Ga.

But this does not prove positively that the storm was not the same at all three places, or that it moved backwards towards the S.W. For a storm of such great length moving side foremost, might have some portions of it advanced before the others, for aught that is known in the present state of

the science. It is possible, however, that the Wilmington date is incorrect by twenty-four hours; and if so, the anomaly here spoken of would disappear. It is hoped that this matter will be settled hereafter. However it may be, the shape of the storm utterly precludes the idea of the whirlwind character, even if the direction of the wind had not been given in the several localities. But when the reader comes to the data below, imperfect as they are, he will discover this remarkable fact: that on the 17th, the wind in the Atlantic, some distance from the coast, was blowing from the S.E. all the way from Georgia to Maryland, and at the same time on shore for that whole distance it was blowing from the N.W.; and that N.E. of Maryland, as far as Long Island Sound, the wind was N.E., and that the only record we have of a ship on the S.W. of this area, the Blanche, shows the wind on the 17th all day from the S.W., with fresh breezes at the end of a violent storm.

There are some deviations it is true, but not so great as to prevent the above statement being, in the general, true. I shall now give all the documents as copied by Col. Reid from Mr. Redfield, together with some additional ones which I have found in the newspapers of that time, and leave the reader, without a woodcut of this storm, to examine the documents for himself. In doing so, I would recommend him to have a map of the coast of the U. S. open before him.

Hurricane of 1830.

"This storm, or hurricane, was severe at the Island of St. Thomas, on the night between the 12th and 13th of August, 1830.

"On the afternoon of August 14, and the succeeding night, it continued its course along the Bahama Islands, the wind veering almost round the compass, during the existence of the storm.

"On the 15th of August the storm prevailed in the Florida channel, and was very disastrous in its effects.

"In lat. 26° 51′, lon. 79° 40′, in the Florida stream, the gale was severe on the 15th, from N.N.E. to S.W.

"Late on the 15th, off St. Augustine, Florida, in lat. 29° 58′, lon. 80° 20′, the gale was very severe.

"At St. Andrews, 20 miles N. of St. Mary's, Georgia, from 8 o'clock P. M. on the 15th, to 2 A. M. on the 16th, the storm was from an eastern quarter, then changed to S.W., and blew till 8 A. M.

"Off Tybee, and at Savannah, Georgia, on the night of the 15th, changed to N.W. at 9 A. M. on the 16th, and blew till 12 M.

"At Charleston, S. C. on the 16th, the gale was from the S.E. and E. till 4 P. M., then N.E., and round to N.W.

"At Wilmington, N. C., the wind was from the E., and veered subsequently to the W.

"In the interior of North Carolina, the storm was felt at Fayetteville.

"In the vicinity of Cape Hatteras, at sea, the storm was very heavy from the S.E., and shifted to N.W.

"A vessel bound from New York to Hayti, in the middle or outer part of the Gulf Stream, about lat. 33°, lon. 72°, experienced the gale moderately from the S.W. and S.S.W., but with a heavy sea from a very westerly direction, and is supposed to have been on the outer margin of the storm.

"Another vessel, at about the same distance from the coast, experienced similar effects.

"Early on the morning of the 17th, the gale was felt severely at Norfolk, and also in Chesapeake Bay from the N.E.

"Off the Capes of Virginia, on the 17th, in lat. 36° 20′, lon. 74°, 2′, 'a perfect hurricane,' from S. to S.S.E., from 5 A. M. to 2 P. M., then shifted to N.W.

"On the 19th, (17th?) in lat. 37° 30′, lon. 74° 30′, near the coast of Virginia, the gale was severe at E.N.E., and changed to W.N.W.

"Off Chincoteague, Md., precise distance from the coast unknown, the gale was severe between S.S.E. and N.N.E.

"Off the coast of Delaware, in lat. 38°, lon. 72°, 'tremendous gale,' commencing at S.E. at 1 P. M. on the 17th, and blowing six hours, then changed to N.W.

"At Cape May, N. J., the gale was N.E. Off Cape May, in lat. 39°, lon. 74° 15′, heavy gale from E.N.E. on the afternoon of the 17th of August.

"Near Egg Harbour, coast of New Jersey, the gale was heavy at N.E. on the same afternoon.

"Off the same coast, in lat. 39°, lon. 73°, the gale at E.N.E.

"In the same lat., lon. 70° 30′, 'tremendous gale,' commencing at S.S.E. and veering to N.

"At New York, and on Long Island Sound, the gale was at N.N.E. and N.E. on the afternoon and evening of the 17th.

"Off Nantucket Shoals, at 8 P. M., the gale commenced severe at N.E. by E.

"In the Gulf Stream, off Nantucket, in lat. 38° 15′, lon. 67° 30′, on the night of the 17th, 'tremendous hurricane,' commencing at S., and veering with increasing severity to S.W., W., and N.W.

"At Elizabeth Island, Chatham, and Cape Cod, Mass., the gale was severe at N.E. on the night between the 17th and 18th of August.

"On the 18th, heavy gale from N.E. at Salem and Newburyport, Mass.

"Early on the 18th, in lat. 39° 51′, lon. 69°, severe gale from S.E., suddenly shifting to N.

"In lat. 41° 20′, lon. 66° 25′, 'tremendous hurricane' from N.N.E. on the 18th of August.

"On the night of the 18th, off Sable Island, and near Porpoise Bank, in lat. 43°, lon. 59° 30′, 'tremendous gale from S. and S.W. to W. and N.W.

"In lat. 43°, lon. 58°, severe gale from the S., the manner of change not reported. This remarkable storm seems to have passed over the whole route comprised in the foregoing sketch in about six days, or at an average rate of about 17 geographical miles per hour.

"The duration of the most violent portion of the storm, at the several points over which it passed, may be stated at from 7 to 12 hours.

"The general width of the tract, influenced, in a greater or less degree, by the gale on the American coast, is estimated to have been from 5 to 600 miles.

"Width of the hurricane portion of the tract, or severe part of the gale, 150 to 250 miles.

"Semi diameter of the hurricane portion of the storm, 75 to 125 miles.

"Rate of the storm's progress from the Island of St. Thomas to Providence Island, Bahamas, 15 nautical miles per hour.

"Rate of progress from Providence to St. John's, Florida, 16 miles per hour.

"From St. John's to Cape Hatteras, N. C. 16½ miles per hour.

"From Cape Hatteras to Nantucket, on the south-eastern coast of Massachusetts, 18 miles per hour.

"From Nantucket to Sable Island, off the south-eastern coast of Nova Scotia, 20 miles per hour."

Extract of a letter from the Master of the Ship Illinois.

I sailed from New Orleans on the 3d of August, bound to Liverpool. Nothing worth notice occurred until the 15th of August, in lat. 33°, N. lon. 77° 10', when there was a very heavy swell from the S., more than ever I had experienced before in this part, unless preceded by heavy gales. We had no indication of wind at this time, but there was a dull and heavy appearance in the S. During the day, the wind was light and at S.E.; at night it shifted to S.S.W. On the 16th, it was a fresh and wholesome breeze; so that with the help of the Gulf Stream we ran at a great rate, steering N.E., and at noon we were in lat. 36°, lon. 73°. On the 17th, the wind continued steady at S.S.W., blowing a strong and wholesome breeze, but the appearance to the S. continued dull and heavy; the sea was smooth again, and we seemed to have outrun the southerly swell. At noon, lat. 37° 58', lon. 69° 23', we were still continuing to run about the course of the Gulf Stream; the temperature of the water was 86° on the first of the 18th, (afternoon of the 17th, current time,) the wind backed to the S., and began to freshen in very fast; some heavy clouds arising in the S. W., with flashes of lightning in that quarter. At 8 P. M. the wind had increased to a strong gale; the weather at this time had an unusual appearance, but still it did not look bad. At 10, the wind had increased, and we took in our sails, and prepared for the worst. At 11 o'clock, the sea ran high and cross, which induced me to heave the ship to under a close reefed topsail. At half past 12, midnight, all was darkness; the heavy clouds which had been rising in the S.W. had overtaken us; the rain fell in torrents, and the lightning was uncommonly vivid; the wind had increased in the space of an hour from a moderate gale to a perfect hurricane. At half past 1 A. M., it began to veer to the westward. At 3 A. M. it was west, and rather increased in violence, as it shifted. At daylight, the sky was clear, but the gale, if any thing, rather increased in its fury; the sea was tremendous, and ran in every direction. At 7, the wind had got to the N.W., and at 9 it began to abate a little.

Extract from the log of the Blanche.—At 1 A. M. of the 15th, wind N. easterly, fresh breezes and squally. At 6, wind northerly, strong gales, with violent squalls; at 9 a hurricane; at 11h. 30m. wind changed to N.W. and blew more violently.

At 1 P. M. south-westerly; at 2 more moderate; at 4 ditto weather; at 7 wind W. by N.; from 8 till midnight, strong gales and squally.

At 1 A. M. of 16th, wind S. by E., strong gales and squally; at 8 ditto weather; at noon fresh gales and squally; at 1 P. M. wind S.W., fresh breezes and squally; at 6 and 8 strong gales.

At 1 A. M. of 17th, wind S. by W., fresh breezes and squally, with rain; at 10 fresh breezes with a heavy swell; at noon fresh breezes and cloudy weather; at 1 P. M. wind S.W., fresh breezes and cloudy weather, and so till midnight. On the 15th, at noon, lat. 27° 15', lon. 79° 35'. On 16th, lat. 30° 12', lon. 79° 22'. On 17th, lat. 31° 42', lon. 76° 59'.

Documents of the Storm of 17th August, 1830, collected by J. P. Espy.

National Gazette of 28th.—A Norfolk paper of Thursday, 19th. The canopy has been overcast for two days with clouds, indicating a storm. The wind blew very heavy on Tuesday night, 17th, from N.E.; shifted yesterday morning to N., and is still blowing a gale, with every appearance

of something more severe in reserve. The tide was much higher yesterday in our harbour than on any day this season, overflowing most of the wharves.

Same paper of 26th. Crow Island, (North Santee) August 17. On Monday, the 16th, about an hour before day, we had a fall of rain, the wind at S.E. The rain fell in showers throughout the day, and the wind increased rapidly till 12, when it blew a hurricane. The wind continued from the same quarter, and increased till some time in the night. The tide rose higher than I ever saw it. Mr. Pinckney's vessel is on my island, near my barn.

Same paper of 31st. Ship Brilliant, on the 18th, lat. 40°, lon 71°, experienced a heavy gale of wind; had all the sails torn to tatters.

Nat. Gaz. of Sept. 7th. Schooner Neuse was wrecked on the S. side of Abaco, on the 15th.

Same paper of 8th Sept. The captain of the Neuse says that the hurricane commenced on the afternoon of the 14th, and lasted 18 hours—the gale was not felt at Nassau, only 60 miles distant. The brig Native was wrecked on the 15th on the S.W. part of Heneagus.

Same paper of 28th Sept. At New Orleans it blew a gale between the 15th and 20th. The Mary Jane was driven on shore on the S.W. side of Abaco. Same paper of 30th. The Ceres fell in with the wreck of the Julia in lat. 28°, lon. 66°, on the 18th Sept.

Same paper of Aug. 31. Sloop Excel was driven on shore on Wednesday, 18th, a little to the westward of Lynnhaven Inlet, during a severe blow from N.N.E.

Same paper of 30th Aug. At Wilmington, N. C. the New Hanover rode out the gale and went to sea on the 17th, the wind having subsided.

At Elizabeth City, N. C. the storm was terribly severe, with torrents of rain on Tuesday, the 17th. At Wilmington, N. C. it was on the night of the 15th, unless there is some mistake in the date—also very violent. In lat. 29° 58′, lon. 80° 50′, the barque New Prospect experienced a severe gale on the 15th and 16th, and was abandoned.

Same paper of 24th. At Charleston, S. C. the wind began to blow about midnight of 15th from S.E. and E.S.E., and continued with increasing force, doing much mischief, till about 4 P. M., when it changed to N.W.

Same paper of 22d. Near Norfolk, Virginia, the corn on either side of the road was completely prostrate, and large trees were torn up by the roots, by the violence of the gale.

Same paper of 21st. There was a heavy blow from the N.E. on the 17th, off Great Egg Harbour.

American Sentinel, Aug. 25th. The Damon, on the 17th, off Chincoteague, experienced a severe gale from S.E. to N.N.E., and the T. Sophia, in lat. 37° 30′, lon. 74° 30′, had a gale from N.N.W.

Aug. 26th. At Savannah, on Sunday night, 15th, from 1 till 9 o'clock of Monday, the 16th, severe gales and heavy rains at intervals from N.E. Between 9 and 10, wind changed to N.W., whence it continued without abatement till 12, when it moderated and blew from the westward during P. M.

Barque H. Astor was, on the 19th, in lat. 30°, lon. 68° 24′; had experienced, the day before, a tremendous hurricane from the N.N.E.—from New Orleans to New York.

Same paper of 27th. Brig Mary experienced a tremendous gale of wind on the 14th, in lat. 27° 59′, lon. 76° 50′, from the E.N.E., which shifted to

E.S.E., and it lasted three days. The John Shand was abandoned, having taken the gale on the 15th, in lat. 31°, lon. 77° 20′.

Same paper of 28th. At Washington, N. C. a violent gale of wind from S.S.E., and rain on Monday night, 16th.

Same paper of Aug. 31. Schr. Mary Ann, on 17th, lat. 38° 48′; severe gale from S.E. to S.S.E.

On 18th, in lat. 43°, lon. 58°, heavy gale from the southward. Off the Highlands, blowing very heavy from the northward.

National Intelligencer, Aug. 26th. At Wilmington, N. C., about 8 P. M. of 15th, the storm set in with hard blowing from the E., and increased gradually till 9, when the wind began to rage with as much fury as we can remember in any former storm, and continued so for four hours, changing to the W. between 11 and 12. On the same night, the wind at Charleston began to blow freshly from the S.E. and E.S.E. about 12, continuing with rapidly increasing violence the succeeding day, and still blowing with diminished violence on the 17th.

American Sentinel of August 24th. Aug. 18, lat. 37° 20′, lon. 75°, at 10 A. M., hove to in a heavy gale, S.E. At half past 12, wind hauled suddenly in to the N. and N.W., and blew a hurricane.

Same paper, Aug. 25. Lon. 72° 42′, lat. from 38° 21′ to 40° 30′, at noon appearance of a storm; at 3 to 4, violent hurricane; in P. M. changed suddenly to N., increasing to a tornado. Same paper says the wind changed round by N.E. suddenly about 4 P. M. of the 16th, at Charleston, and S. to N.W.

Same paper, Aug. 28. Schooner Packet, 30 miles S.E. of Tybee light, experienced the gale on the 16th, from S.S.E., shifting to W.S.W. Aug. 30. Capt. Hipkins experienced the gale on the 18th, in lat. 34° 45′, lon. 73°, but sustained no injury.

Same paper of 31st. Ship Hellespont, off Sable Island, experienced a severe gale from S.W. to N.N.W., which lasted eleven hours. Sept. 1. A tremendous hurricane from N.N.W. on 17th, in lat. 40° 14′, lon. 70°. Also ship Brilliant, lat. 40°, lon. 71°, experienced a heavy gale from the N. for 4 hours on the 18th.

Hospital, Philadelphia, Aug. 1830.

Day.	Therm. and Wind.			Atmosphere.		
	7h.	12h.	3h	7h.	12h.	3h.
14	68 E.	83 S.W.	85 S.W.	Fog.	Clear.	Clear.
15	74 S.W.	83 S.		Cloudy.	Cloudy.	Clear.
16	79 S.W.	91 S.W.	76 S.W.			
17	71 N.E.	71½ N.E.	69 N.E.	Rain.	Rain.	Rain.
18	61 N.W.	72 N.W.	74 N.W.	Clear.	Clear.	Clear.
19	64 N.W.	75 N.E.	79 N.E.	"	"	"

Rain on 15th, . . . 0.16 inch.
" 16th, . . . 1.10 "
" 17th, . . . 61 "

These are all the documents which we have of this storm. They are very imperfect; yet they furnish proof of these three things:—

1st. The storm was several hundred miles longer from N.N.E. to S.S.W. than it was from W.N.W. to E.S.E.

2d. It moved eastwardly with a velocity not exactly ascertained; much less, however, than if its velocity should be estimated from its appearance along the coast of the United States.

3d. The wind set in generally out at sea from the S.E., and changed round to N.W.

From the following quotation, it would appear that a storm similar to this in shape had its longest diameter from E. to W., and traveled from N. to S. More information as to the shape of storms, and the direction in which they move, is much wanted.

"After a few days pretty fresh breezes from the S., clouds suddenly appeared in the N., and, by the motion of the water, we perceived that an equally strong wind was rising in that direction. The waves from the opposite regions foamed and raged against each other like hostile forces; but between them lay a path some fathoms broad, and stretching from E. to W. to an immeasurable length, which appeared perfectly neutral ground, and enjoyed all the repose of the most profound peace, not a single breath troubling the glassy smoothness of its surface. After a time, victory declared for Boreas, and he drove the smooth strip towards our vessel, which had hitherto been sailing in the territory of the S. wind.

"We presently entered the calm region; and while we had not a puff to swell our sails, the wind raged with undiminished fury on both sides. This strange spectacle lasted for about a quarter of an hour, when the N. wind, which had been continually advancing, reached us, and carried us quickly forward towards the place of our destination."—See Kotzebue's New Voyage Round the World, vol. ii., p. 72. Off California.

An Account of the Fatal Hurricane by which Barbadoes suffered in August, 1831, *by the Editor of the West Indian.*

Page 33.—"On the 10th morning of the month, the sun arose without a cloud, and shone resplendently through an atmosphere of the most translucent brightness. At 6 A. M. the thermometer stood as high as 83, which indicated the heat to be one degree greater than at sunset the preceding evening. At 8 it rose to 85, and at 10 to 86, at which hour the gentle breeze which had fanned the country died away. After a temporary calm, high winds sprang up from the E.N.E., which in their turn subsided; calms for the most part then prevailed, interrupted by occasional sudden puffs from between the N. and N.E. At noon the heat increased to 87, and at 2 P. M. to 88, at which time the weather was uncommonly sultry and oppressive. At 4 the mercury sank to 86. Until that hour the observations on the weather, as here detailed, were made in Bridgetown. At 5 P. M. the writer, being about a mile and a half to the northward of the town, remarked the clouds gathering very densely from the N.; the wind commenced to blow very freshly from the same point.

A shower of rain presently fell, and was succeeded by a sudden stillness, to which a solemnity was added by the dismal blackness of the horizon all around. The impenetrable body of cloud extended upwards towards the zenith, leaving there an obscure circle of imperfect light, the diameter of which appeared to be about 35 or 40 degrees of the celestial concave. This dismal circle remained at rest for a very few moments; when the scud of it was seen to be in a state of ebullition; the dense mass of clouds all around was agitated, and separating bodies of it were quickly dispersed to all points of the compass. From 6 to 7 the weather was fair and the wind moderate,

with occasional slight puffs from the N.; the lower and principal stratum of clouds passing fleetly towards the S., the higher strata and scud rapidly flying to various points: after 7, the sky was clear and the air calm: tranquillity reigned till a little after 9, when the wind again blew from the N. At half past 9 it freshened, and moderate showers of rain fell at intervals for the next hour. Distant lightning was observed at half past 10, in the N.N.E. and N.W. Squalls of wind and rain from the N.N.E, with intermediate calms succeeded each other until midnight, the thermometer in the meantime varied with remarkable activity; during the calms it rose as high as 86, at other moments fluctuated from 83 to 85.

After midnight, the continual flashing of lightning was awfully grand, and a gale blew fiercely from between the N. and N.E. At 1 A. M. of the 11th the tempestuous rage of the wind increased; the storm, which at one moment blew from the N.E., suddenly shifted from that quarter, and burst from the N.W. and intermediate points. The upper regions were, from this, illuminated by incessant lightning, but the quivering sheet of blaze was surpassed in brilliancy by the darts of electric fire which were explored in every direction. At a little after 2, the astounding roar of the hurricane which rushed from the N.N.W. and N.W. cannot by language be described. About 3, the wind occasionally abated, but intervening gusts proceeded from the S.W., the W., and W.N.W., with accumulated fury. The lightning also having ceased for a few moments only at a time; the blackness in which the town was enveloped was inexpressibly awful. Fiery meteors were presently seen falling from the heavens; one in particular, of a globular form, and a deep red hue, was observed by the writer to descend perpendicularly from a vast height. It evidently fell by its specific gravity, and was not shot or propelled by any extraneous force. On approaching the earth, with accelerated force, it assumed a dazzling whiteness and an elongated form, and dashing to the ground in Beckwith Square, opposite the stores of Messrs. H. D. Grierson and Co., it splashed around in the same manner as melted metal would have done, and was instantly extinct. In shape and size, it appeared much like a common barrel shade. Its brilliancy, and the sparkling of its particles on meeting the earth, gave it the resemblance of a body of quicksilver of equal bulk. A few minutes after the appearance of this phenomenon, the deafening noise of the wind sank to a solemn murmur, or, more correctly expressed, a distant roar, and the lightning, which, from midnight, had flashed and darted forkedly, with few and but momentary intermissions, now, for the space of nearly half a minute, played frightfully between the clouds and the earth, with novel and surprising action; the vast body of vapour appeared to touch the houses, and issued downward flaming blazes, which were nimbly returned from the earth upward. The corruscations, for the short space of time they continued, instantly succeeding each other. This strange quivering, or darting, of flashes down and up, may be compared to the miniature blazing produced by the rapid and irregular discharge of opposing artillery closely engaged. Whilst this remarkable phenomenon proceeded, the earth vibrated in a manner, and in time, answering with the action of the lightning. Twice, or more, when the corruscations were more brilliant and severe, but less rapid in succession, the earth received corresponding shocks. The moment after these singular alternations of lightning, the hurricane again burst from the western points with violence prodigious beyond conception, hurling before it thousands of missiles, the fragments of every unsheltered structure of human art. The strongest houses were caused to vibrate to their foundations, and

the surface of the very earth trembled as the destroyer raged over it. No thunder was at any time distinctly heard;—had the cannon of a hundred contending armies been discharged, or the fulmination of the most tremendous thunderclaps rattled through the air, the sounds could not have been distinguished. The horrible roar and yelling of the wind, the noise of the tumultuous ocean, whose frightful waves threatened the town with the destruction of all that the other elements might spare, the clattering of tiles, the falling of roofs and walls, and the combination of a thousand other sounds, formed a hideous din, which appalled the heart, and bewildered, if not alienated, the mind. No adequate idea of the sensations which then distracted and confounded the faculties, can possibly be conveyed to those who were distant from the scene of terror. The sheltered observer of the storm, amazed and in a state of stupor, was fixed to the spot where he stood; the sight and the hearing were overpowered, and the excess of astonishment refused admission to fear. What must have been the mental agonies of those wretched fugitives, who, destitute of a place of refuge, were the sport of the dreadful tempest, and alive to all its horrors! This unparalleled uproar continued, without intermission, until half past 4, the raging blast coming from the W., and other points to the southward of it, attended with frequent dashing and pelting rain. After 5 o'clock, the storm now and then for a few moments abated, at which time the dreadful roar of the elements having partially subsided, the falling of tiles and building materials, which, by the last gust, had probably been carried to a lofty height —the shrieks of the suffering victims—the cries of the terrified inhabitants, and the howlings of dogs, were clearly audible, and awakened the mind to an apprehension of the havoc and carnage which had been, and still were, desolating the colony.

At half past 5, after a dreadful gust from the W.S.W., the wind suddenly chopped round to the E., from whence it blew a moderate gale, which in a minute increased, and changing to the S.E., a hurricane again raged, but unaccompanied by those fatal gusts, which, from the western quarter, had effected so much destruction. Torrents of rain at this time fell. At 6, the hurricane blew suddenly and tremendously from the S., driving the sheets of rain horizontally before it. This continued till 7, when the wind, then from S.E., was more moderate; but floods of rain still deluged the ruins of the town, and the population, who were now destitute of any shelter. At 8 A. M., strong breezes blew from E.S.E.; after that hour, the dense cloud began to break up, and at 10, the sun for a few moments darted its rays over a prospect of wretchedness more replete with real misery and sickening to the heart, than the field of battle after a sanguinary contest."

The centre of this storm appears to have passed a little to the N. of Barbadoes, and over the southern extremity of St. Lucia.

On the evening of the 10th, no unusual appearance had been observed at St. Lucia; but as early as 4 or 5 o'clock next morning, the garrison, stationed near the northern extremity of the island, began to be alarmed: some hut barracks blew down, and the wind was then nearly N.

The storm was at its greatest height between 8 and 10 o'clock in the morning; but from that time the wind gradually veered round to the E., diminishing in force and dwindling, as it were, to nothing in the S.E., and it was succeeded by a beautiful evening, with scarcely a breath of wind.

At the southern extremity of the island, the most violent part of the storm is reported to have been from the S.W. At St. Vincent, the garri-

son was at Fort Charlotte, near the S.W. point of the island; and there the wind first set in from N.W., veering to W. and to S.W., raising the water in Kingston Bay so as to flood the streets; and it unroofed several of the buildings in the fort, and blew down others: but at Martinique (as will be seen from the following report printed in the "London Shipping List," for 1831,) the wind was easterly during the gale.

"Paris, Sept. 15, 1831.—The Martial arrived at Havre from Martinique; sailed on the 15th of August. On the 11th of August, a gale at E. was experienced there which lasted six hours. The plantations suffered severely. Two vessels belonging to Bordeaux, and all the Americans at anchor in the road of St. Pierre, were driven out to sea. The army schooner, the Duke of York, on her return from Trinidad to Barbadoes, during this hurricane, was in sight of Grenada in the evening, and to the eastward of that island. About midnight she first began to experience hard squalls from the N.W., which caused the master to take in sail. The squalls increased until the vessel could carry no sail at all, and she was expected every moment to founder. Happily, at daylight, those on board of her unexpectedly found themselves drifted close to the island of Barbadoes.

These are all the accounts we have of this hurricane, yet, meagre as they are, the reader will perceive that during the two last hours of the hurricane at Barbadoes, after the wind changed round there S.E., it was N. at St. Lucia, and certainly between N.W. and S.W. at St. Vincent, and therefore at this time it was blowing inwards towards a central space, not far, undoubtedly, from where the middle of the storm then was.

I now take leave of Col. Reid for the present, thanking him most sincerely for the many interesting facts with which he has enriched the science of meteorology.

At some future time I shall have something to say of his water spouts—when I hope I shall be able to prove, by numerous facts, that the wind blows inwards, upwards in the middle, and outwards above, in this meteor, as well as in the great storms above investigated. Indeed, if it is certain that the wind blows inwards in one storm, there is a strong presumption that it does so in all.

Now, Howard says, in the tremendous gale of 20th March, 1812: "During the storm, the wind to the southward of the Humber, was from the S. W., whilst to the northward of it, it was strong from the N.E. and by E." And Mr. Forth found, in the storm of Jan. 8th, 1734–5, that while in all England, the barometer was at its lowest point, the wind was N.E. in the northern part of that isle, and S.W. in the southern part. (Obs. sur la Physique, vol. xxxix., p. 106. Also, Phil. Trans. Abridg. vol. ii., p. 497.

Franklin Institute.

REPORT OF THE COMMITTEE ON PREMIUMS AND EXHIBITIONS.

Tenth Exhibition of Domestic Manufactures held by the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts.

To the Managers of the Franklin Institute.

The Committee on Premiums and Exhibitions having received from a majority of the Committees of Judges their reports upon the respective

merits of the various specimens deposited at the late Exhibition held by the Institute, and having decided upon the award of premiums, now close their labours by laying before the Board of Managers a report of their decisions, together with a brief detail of their general proceedings.

As soon as it was decided that an exhibition should be held this season, the Committee announced the design of the Institute in a Circular, which was distributed among the manufacturers in the different parts of the U. States.

The experience of former Exhibitions having shown that when a definite list of articles for which premiums would be awarded, was adopted, some inconvenience arose from the difficulty of foreseeing what would be the character of the specimens offered: the Committee, on this occasion, adopted a different and more liberal course, by leaving the whole matter open, so as to admit into competition all articles of American manufacture which should possess especial merit. They did not, therefore, publish any list of premiums, but invited competition in every possible shape. The result has more than justified their expectations, and clearly shewn the propriety of the course adopted.

In the month of September, the Committee, in accordance with the usual custom on previous occasions, invited a number of gentlemen who were interested in the subject, to assist in making the preliminary arrangements for the Exhibition.

These gentlemen, to the number of 157, were organized as a Committee of Arrangement by electing Mr. C. C. Haven as Chairman, and immediately upon their organization, commenced the performance of their duties with a zeal and spirit which gave excellent promise of an extensive and interesting Exhibition.

As the Committee of Arrangement advanced in their operations, the prospective extent of the Exhibition was such that it was thought advisable to devote to it not only the greater part of the interior of the Hall, but also to erect in front, on Chesnut street, a temporary building for the accommodation of cooking ranges and stoves, and for the reception of the more bulky articles of machinery and manufactures.

Arrangements were also made for providing a motive power for such machines as could be conveniently put in operation for the gratification of a laudable curiosity.

In consequence of invitations extended by the Committee on Premiums, the Exhibition was visited by a number of distinguished strangers from various sections of the Union, and by delegations from the American Institute and Mechanics' Institute of New York, both of which Societies had held Exhibitions of American Manufactures a short time previous to ours. Beside the gratification which the Committee derive from these visits on personal grounds, it is believed that much advantage must arise from them, both to the Institute and to the noble cause in which it is engaged, by promoting harmony of feeling and unison of efforts among all kindred institutions throughout our country.

This Exhibition is believed to differ from most of those which preceded it in one particular, which, although it was calculated to diminish in some measure its splendour as a mere show of the beautiful and curious, served to render it of greater interest to those who are conversant with the manufactures of our own and foreign lands. At former exhibitions we have generally had a large number of articles offered for premiums which have been made expressly for the occasion, and which were so entirely superior to the

usual quality of the article, as to be no criterion of the existing condition of the ordinary manufacture.

On the present occasion, however, by far the greater portion of the specimens exhibited were taken from the ordinary stock made for general sale, and, as has been observed by some of the Judges in their reports, are fair and honest samples of goods to be found in our stores on sale every day. As a highly gratifying evidence of the progress of the Arts, it may be added that many of these goods which are now considered as nothing out of the common course of productive industry, were reported no longer back than our last Exhibition, to be astonishing evidences of superior skill; but not fair samples of our usual manufactures: and others of them were at that time not recognized as articles of domestic production.

The same cause has served in some measure to diminish the comparative number of awards of Medals for superior excellence, and to increase that of Certificates of Honourable Mention, which may be awarded in all cases of excellence or merit, even where several articles of similar nature shall be found equally meritorious, and which is therefore a much less invidious mode of testifying to the skill of the Manufacturer than the former.

As the remarks made by the Judges, at the time of examining the articles, will serve to give a more just conception of the general character of the Exhibition than could be conveyed by a more elaborate description prepared after the whole had passed away, the Committee have thought it best to make copious extracts from those Reports, instead of offering their own views and opinions.

Although the primary object of the Institute, in originating these periodical displays of domestic productions, has been the promotion of the manufacturing prosperity of the community, it is a source of gratification to find that public favour has rendered them productive of pecuniary benefit; the profits to the Institute, on the present occasion, have been greater than was ever before realized, notwithstanding the heavy expenses incurred in making preparations.

The following awards of Premiums and Honorary Notice have been made in accordance with the recommendations of the Judges, except in a few cases where the Judges neglected to act, or omitted to notice some deserving specimens. In these cases, the Committee on Premiums have awarded such premiums as, in their opinion, were equitable.

Cotton Goods.

To Jacob Dunnell, Pawtucket, R. I., for specimen No. 206, 9 pieces of Chintz, in imitation of the French, deposited by Fales, Lothrop & Co.

Silver Medal.

To the Rockford Cotton Factory, near Wilmington, Delaware, for specimen No. 445, 20 pieces of Long Cloths, deposited by Jos. Bancroft.

Silver Medal.

To Jacob Dunnell, Pawtucket R. I., for specimen No. 69, 6 pieces coloured prints, deposited by Wells & Dunlop.

Certificate of Honorable Mention.

To P. Allen & Son, Providence, R. I., for specimen No. 73, 5 pieces Furniture Chintz, 165¾ yards, deposited by A. & G. Ralston.

Certificate of Honorable Mention.

To the Hamilton Manufacturing Company, Lowell, Massachusetts, for specimen No. 511, 1 piece Canton Flannel, deposited by David S. Brown.

Certificate of Honorable Mention.

To the Merrimack Manufacturing Company, Lowell, Mass., for specimen No. 189, 17 pieces Merrimack Prints, deposited by David S. Brown.
Certificate of Honourable Mention.

To the American Manufacturing Company, Lowell, Mass., 8 pieces American Prints, deposited by David S. Brown.
Certificate of Honourable Mention.

To A. Robeson, Fall River, Mass., for specimen No. 197, 21 pieces Chintzes, deposited by Hacker, Lea & Co.
Certificate of Honourable Mention.

To Sands Olcott, New Hope, Pa., for specimen of Flax, prepared for spinning on cotton machinery. Certificate of Honourable Mention.

Woolen Goods.

To the Middlesex Manufacturing Company, Lowell, Mass., for specimen No. 253, 9 pieces Cassimeres, deposited by David S. Brown.
Silver Medal.

To the Mechanics' Manufacturing Company, Rochester, N. H., for specimen No. 324, 10 pieces Whitney Blankets, deposited by D. S. Brown
Silver Medal.

To the Bristol Manufacturing Company, Connecticut, for specimen Nos. 139 and 140, 2 pieces Black Satinet, deposited by B. Hindman & Co.
Certificate of Honourable Mention.

To the Minot Manufacturing Company, Enfield, Mass., for specimen No 254, 4 pieces Satinets, deposited by David S. Brown.
Certificate of Honourable Mention.

To J. & J. Eddey, Fall River, Mass., for specimen No. 486, 6 pieces Satinets, deposited by Farnum, Newhall & Bettle.
Certificate of Honourable Mention.

To Zachariah Allen, Providence, R. I., for specimen No. 270, 1 piece Brown Broadcloth, deposited by C. C. Haven & Co.
Certificate of Honourable Mention.

To E. Wrigley, Philadelphia, for specimen No. 520, 2 pieces Drab Cloth.
Certificate of Honourable Mention.

To the New England Worsted Manufacturing Company, Framingham, Mass., for specimens No. 66, 5 pieces White, and No. 67, 5 pieces Green, Kerseys, deposited by Phipps, Heberton & Abbot.
Certificate of Honourable Mention.

To the Mechanics' Manufacturing Company, Rochester, N. H., for specimens Nos. 274 and 275, 5 pieces Bed Blankets, deposited by C. C. Haven & Co. Certificate of Honourable Mention.

Carpets.

To Caspar Rehn, Philadelphia, for specimen No. 531, 1 piece Carpet deposited by William L. Rehn. Certificate of Honourable Mention.

Silks.

To the Philadelphia Silk Culture and Manufacturing Company, E. O. Abbot, Agent, for specimen No. 179, 2 bundles Sewing Silk, deposited by J. C. Kempton. Silver Medal.

To Edward F. Gay, Philadelphia, for display of Manufactured Silks and Silk Machinery. Certificate of Honourable Mention.

To Jonathan Dennis, jr. Portsmouth, R. I., for specimen No. 176, Silk Spinning and specimen of Silk. Certificate of Honourable Mention.

To Miss Gertrude Rapp, Economy, Pa., for specimens Nos. 24, 25, 26 and 27, Black and Figured Satin Vestings, deposited by Paul Moody. Certificate of Honourable Mention.

Straw Goods.

To Thomas White, Philadelphia, for specimen No. 89, 8 Straw Bonnets. Silver Medal.

Surgical Instruments and Dentistry.

To P. Madeira, Philadelphia, for specimens Nos. 190 and 191, an assortment of Surgical and Dental Instruments. Certificate of Honourable Mention.

Messrs. Wiegand & Snowden also exhibited a variety of Surgical Instruments of their usual excellence, but they can receive no award, as Mr. Wiegand is a Manager of the Institute.

To S. W. Stockton, Philadelphia, for specimen No. 149, 2 cases Incorruptible Teeth. Certificate of Honourable Mention.

Iron and Steel.

To A. Denslow, Hartford, Conn., for specimen No. 848, 5 bundles Iron Wire, made from American Iron, deposited by E. J. Etting. Silver Medal.

To J. C. Bryant & Co., Manayunk, for specimen of Iron smelted with Anthracite. Silver Medal.

To Valentine, Harris & Co., Bellefonte, Pa., for specimen No. 91, Lot of Iron and Iron Ore, deposited by E. J. Etting. Certificate of Honourable Mention.

To James Wood & Sons, Philadelphia, for specimen No. 194, 2 bundles Sheet Iron. Certificate of Honourable Mention.

To the Mastic Iron Works, Lancaster county, Pa., for specimen No. 725, 10 bars of Iron. Certificate of Honourable Mention.

To J. Washburn, Worcester, Mass., for specimen No. 707, Card Wire made from foreign Iron. Certificate of Honourable Mention.

Cutlery.

To Rochus Heinisch, Newark, N. J., for specimen No. 327, 12 pairs Tailors' Shears, deposited by Charles Harkness. Silver Medal.

Copper and Brass.

To Crocker, Brother & Co., Taunton, Mass., for specimens No. 283, 2 sheets Zinc, and No. 284, 3 sheets Copper, deposited by A. W. Metcalf & Co. Certificate of Honourable Mention.

Hardware and Edge Tools.

To William Rowland, Philadelphia, for specimen No. 34, 1 case Mill Saws. Silver Medal.

To Hill & Winship, Amherst, Mass., for specimen No. 138, 1 lot of Planes, deposited by Joseph P. Hornor & Son. Silver Medal.

To Day, Newell & Day, New York, for specimen No. 495, 5 Locks. Silver Medal.

To Rockwell & Hinsdale, Winchester, Connecticut, for specimen No. 130, 4 Corn Scythes, deposited by Wm. Hart Carr & Co.
Certificate of Honourable Mention.

To Hale, Whipple & Waters, Millbury, Mass., for specimen No. 293, 5 Scythes. Certificate of Honourable Mention.

To Hamen Chapin, New Hartford, Conn., for specimen No. 124, 1 case Carpenters' Planes, deposited by Beckley & Shipman.
Certificate of Honourable Mention.

To John Colton, Philadelphia, for specimens Nos. 343, 344 ,345, and 544, an assortment of Planes. Certificate of Honourable Mention.

To Israel White, Philadelphia, for specimen No. 688, 16 Bead Planes.
Certificate of Honourable Menton.

To E. W. Carpenter, Lancaster, Pa., for specimen No. 513, 5 Planes, assorted. Certificate of Honourable Mention.

The Planes deposited by several other makers were good articles, but the number deposited by any one manufacturer were too small to entitle them to a certificate.

To James Wood & Sons, Philadelphia, for specimen No. 194, samples of Saws. Certificate of Honourable Mention.

To Aaron Nichols, Philadelphia, for specimen No. 286, Circular Saws, deposited by A. W. Metcalf & Co. Certificate of Honourable Mention.

To Savary, Shaw & Co., Philadelphia, for specimen No. 9, Hollow Ware.
Certificate of Honourable Mention.

To Baily & Putnam, Malden, Mass., for specimen No. 282, an assortment of Britannia Ware. Certificate of Honourable Mention.

To Leonard, Reed & Barton, Taunton, Mass., for specimen No. 766, an assortment of Britannia Ware. Certificate of Honourable Mention.

To William Beatty & Son, Springfield, Delaware county, for specimens Nos. 1 to 8, and 59 to 65, 2 lots of Edge Tools, deposited by J. B. Baxter & Son, and Smith & Brothers. Certificate of Honourable Mention.

To John Beatty, Philadelphia, for specimens Nos. 41 to 58, lot of Edge Tools. Certificate of Honourable Mention.

To the Douglass Axe Manufacturing Company, East Douglass, Mass., for specimens Nos. 97 to 108, lot of Axes and Hatchets, deposited by W. H. Carr & Co. Certificate of Honourable Mention.

To D. Simmons & Co., Cohoes and Trenton, N. J., for specimen No. 401, 1 case Edge Tools, deposited by Curtis & Hand.
Certificate of Honourable Mention.

To the Taunton Manufacturing Company, Mass., for specimen No. 437, 6 pieces Edge Tools, deposited by Moore, Heyl & Co.
Certificate of Honourable Mention.

To D. C. Stone & Co., Naponock, N. Y., for specimen No. 453, 11 pieces Edge Tools, deposited by William H. Carr & Co.
Certificate of Honourable Mention.

To Collins & Co., Ulster county, N. Y., for specimen No. 526, 2 boxes of Axes, deposited by Samuel Rogers. Certificate of Honourable Mention.

To Moses Bates, jr., East Bridgewater, Mass., for specimen No. 469, 1 case Shoemaker's Tools, deposited by W. H. Carr & Co.
Certificate of Honourable Mention.

To T. J. & S. Kane, New York, for specimen No. 657, 1 Rack Vice.
Certificate of Honourable Mention.

To E. Brady, New York, for specimen No. 196, Smiths' Vices.
Certificate of Honourable Mention.

To Blake & Brothers, New Haven, Conn., for specimen No. 377, Locks and Latches, deposited by Curtis & Hand.
Certificate of Honourable Mention.

To Augustus Prutzman, Philadelphia, for specimen No. 419, 5 Locks.
Certificate of Honourable Mention.

To Joseph Nock, Philadelphia, for specimen No. 636, Trunk Locks, and Padlocks. Certificate of Honourable Mention.

To Wm. Heywood, Philadelphia, for specimen No. 455, 1 Bank Lock.
Certificate of Honourable Mention.

To the Nashua Lock Co., Nashua, N. H., for specimen No. 334, 1 Mortise Lock. Certificate of Honourable Mention.

To D. Adams & Co., Springfield, Vermont, for specimen No. 79, 5 reams Sand Paper. Certificate of Honourable Mention.

Messrs. Wm. Hart Carr & Co.'s improved Hay Forks, &c., so highly praised by the Judges, cannot receive a premium, as Mr. Carr is a member of the Board of Managers.

Silver Ware and Jewelry.

To James Thomson, New York, for specimen No. 461, samples of Silver Ware. Certificate of Honourable Mention.

To Jacob Bennett, Philadelphia, for specimen No. 65, Silver Writing Apparatus. Certificate of Honourable Mention.

To Samuel Kirk, Baltimore, for specimen No. 720, Silver Tea Service.
Certificate of Honourable Mention.

The Silver Ware exhibited by Messrs. Fletcher & Bennett, of this city, was deemed fully equal, in beauty and quality, to the specimens above noticed, but they are excluded from any award, in consequence of Mr. Fletcher being an officer of the Institute.

To J. J. Lowndes, Philadelphia, for specimen No. 759, Gold Pencils.
Certificate of Honourable Mention.

To W. J. Mullin, New York, for specimens No. 577 and 724, Gold Watch Dials. Certificate of Honourable Mention.

Stoves and Grates.

To E. Barrow, Philadelphia, for specimen No. 540, one Cooking Range.
Silver Medal.

To H. & F. Stimson, Boston, for specimen No. 159, Cooking Range.
Certificate of Honourable Mention.

To Auld & Cox, Philadelphia, for specimen No. 433, Cook Stove, deposited by Charles M'Neall. Certificate of Honourable Mention.

To Josiah Kisterbock, Philadelphia, for specimen No. 513, 2 Cook Stoves.
Certificate of Honourable Mention.

To Josiah Kirk, Philadelphia, for specimen No. 514, Cook Stove.
Certificate of Honourable Mention.

Philosophical Apparatus.

To Amasa Holcomb, Southwick, Mass., for specimen No. 409, a Reflecting Telescope. Silver Medal.

To Joseph Saxton, Philadelphia, for specimen No. 182, Balance for Adjustment of Weight at United States Mint. Silver Medal.

To Henry F. Piaget, of New York, for specimen No. 591, Pocket Watch with Double Power Movement. Silver Medal.

To Edmund Draper, Philadelphia, for specimen No. 213, two Theodolites. Certificate of Honourable Mention.

To W. J. Young, Philadelphia, for specimen No. 347, 2 Surveyors' Compasses. Certificate of Honourable Mention.

To Archibald Little, Camden, N. J., for specimen No. 752, Chronometer with his patent Escapement. Certificate of Honourable Mention.

To Alva Mason, Philadelphia, for specimen No. 222, assortment of Philosophical Apparatus. Certificate of Honourable Mention.

Guns.

To William Jenks, Chickopee Falls, Mass., for specimen No. 160, Rifle, loading at Breech. Silver Medal.

To W. Lovering & Co., Taunton, Mass., for specimen No. 288, rotary barrel Pistols. Certificate of Honourable Mention.

To the Patent Arms Manufactory, Paterson, N. J., for specimen No. 518, Guns, Rifles and Pistols. Certificate of Honourable Mention.

Models and Machinery.

To James Brooks, Philadelphia, for specimen No. 679, Locomotive Engine of improved construction. Silver Medal.

To Gaskell & Copper, Philadelphia, for specimen No. 478, Book Binders' Tools. Silver Medal.

To William M. Hartshorne, Philadelphia, for specimen No. 631, Stationary Engine. Certificate of Honourable Mention.

To M. W. & T. Greer, Philadelphia, for specimen No. 829, Steam Engine. Certificate of Honourable Mention.

To Moses Starr & Son, Philadelphia, for specimen No. 850, small Tubular Boiler. Certificate of Honourable Mention.

To E. D. Marshall, Philadelphia, for specimen No. 634, one Slide Rest. Certificate of Honourable Mention.

To N. Moore, Ellsworth, Me., for specimen No. 330, Stave Cutting Machine. Certificate of Honourable Mention.

To Joel Bates, Philadelphia, for specimen No. 632, Fire Engine. Certificate of Honourable Mention.

The Fire Engine made by Mr. Agnew was much admired, but is not permitted to compete for premiums by the rule which excludes Managers of the Institute from awards.

To J. Smith & Co., Philadelphia, for specimen No. 365, Machine for Sticking Cards. Certificate of Honourable Mention.

To L. J. Pope, Boston, for specimen No. 703, Shears for clipping Iron. Certificate of Honourable Mention.

Lamps and Gas Fixtures.

To C. Cornelius & Son, Philadelphia, for specimen No. 680, display of Chandeliers and Gas Fixtures. Silver Medal.

To Whelan & Brown, Philadelphia, for specimen No. 458, six pairs of Gas Fixtures. Certificate of Honourable Mention.

Musical Instruments.

To Gilbert & Co., Boston, for specimen No. 522, Horizontal Piano. Silver Medal.

To Alexander Kirkwood, Philadelphia, for specimen No. 584, one Harp. Certificate of Honourable Mention.

To Jacob Pfaff, Philadelphia, for specimen No. 521, one Flute. Certificate of Honourable Mention.

To C. H. Eisenbrandt, Baltimore, for specimen No. 482, several Flutes and Horns. Certificate of Honourable Mention.

China and Glassware.

To George Dummer, New York, for specimen No. 337, 4 pair Fluted Decanters, deposited by E. E. Smith & E. Douglass. Silver Medal.

To the Boston and Sandwich Glass Company, for specimen No. 174, lot of Glassware, deposited by Joseph Kerr. Certificate of Honourable Mention.

To the Redford Glass Company, New York, for specimen No. 611, one box of Crown Glass, deposited by Wm. M. Muzzy. Certificate of Honourable Mention.

Marble.

To Findley Highlands, Philadelphia, for specimen No. 585, 2 Marble Mantels. Certificate of Honourable Mention.

To T. W. Burchell, Philadelphia, for specimen No. 582, 2 Marble Mantels, and 1 Centre Table. Certificate of Honourable Mention.

To Henry C. Webb, Philadelphia, for specimen No. 448, 1 Marble Mantel, and 2 Statuary Tables. Certificate of Honourable Mention.

To Vanderbilt & Wildes, Philadelphia, for specimen Nos. 578 and 615, 2 Marble Mantels, and 1 Egyptian Marble Table. Certificate of Honourable Mention.

To John Hill, Philadelphia, for specimen No. 595, a Tablet for the tomb of Joseph S. Lewis, Esq. Certificate of Honourable Mention.

To W. Struthers, Philadelphia, for specimen No. 595, a Dial Stand of Italian Marble. Certificate of Honourable Mention.

Mr. John Struthers being a member of the Board of Managers, no award can be made for the Mantels exhibited by him.

Cabinet Ware.

To the Journeymen Cabinet Makers' Society, Philadelphia, for specimen No. 483, &c., an assortment of Cabinet Ware, deposited by Crawford Riddel. Silver Medal.

To John George, Philadelphia, for specimen No. 410, 6 pieces Hair Cloth Seating. Certificate of Honourable Mention.

To N. M'Graw, New York, for specimen No. 625, 1 Sofa Bedstead. Certificate of Honourable Mention.

To William Woolley, New York, for specimen No. 741, 1 Invalid, 1 Traveling, and 1 Sideboard Bedstead. Certificate of Honourable Mention.

To E. J. Cherrington, Boston, Mass., for specimen No. 783, 1 Wardrobe Bedstead. Certificate of Honourable Mention.

Leather and Manufactures of Leather.

To Robert Carey, Philadelphia, for specimen No. 353, 2 setts single Harness. Silver Medal.

To John P. Alberger, Philadelphia, for specimen No. 113, two Leather Trunks. Certificate of Honourable Mention.

To A. L. Hickey, Philadelphia, for specimen No. 145, 3 Patent Leather Trunks. Certificate of Honourable Mention.

To John Migeod, Philadelphia, for specimen No. 306, 1 Patent Leather Trunk. Certificate of Honourable Mention.

To Mogridge, Boustead & Co., Philadelphia, for specimens No. 303, 1 doz. Russet Calf Skins, and No. 304, 12 sides Bridle Leather. Certificate of Honourable Mention.

To Doyle & M'Neilly, Philadelphia, for specimen No. 391, lot of Buckskins for Pianos. Certificate of Honourable Mention.

To John Lippincott, Philadelphia, for specimen No. 118, Chaise Hides. Certificate of Honourable Mention.

To W. & D. Lowber, Philadelphia, for specimen No. 308, samples of Chaise Hides, Certificate of Hónourable Mention.

To Benjamin Shaw, New York, for specimen No. 515, Ladies' Boots. Certificate of Honourable Mention.

To Wm. Bird, Philadelphia, for specimen No. 398, Mens' Boots. Certificate of Honourable Mention.

Combs and Brushes.

To Benjamin Taylor, Philadelphia, for specimen No. 35, an assortment of Brushes. Certificate of Honourable Mention.

To G. W. Morris, Philadelphia, for specimen No. 302, 1 case of Brushes. Certificate of Honourable Mention.

To Myers Busch, Philadelphia, for specimen No. 351, a case of Brushes. Certificate of Honourable Mention.

To Charles J. Abel, Philadelphia, for specimen No. 373, a lot of Brushes. Certificate of Honourable Mention.

Books and Stationary.

To Hogan & Thompson, Philadelphia, for specimen No. 382, a lot of Books and Stationary. Silver Medal.

To Jessup & Brothers, Philadelphia, for specimen No. 85, 4 reams Paper. Silver Medal.

To the Pennsylvania Slate Company, Easton, Northampton county, for specimen No. 154, a lot of School Slates. Certificate of Honourable Mention.

To Josiah Loring, Boston, Mass., for specimen No. 258, a lot of Globes. deposited by Hogan & Thompson. Certificate of Honourable Mention.

To W. J. Abel, Philadelphia, for specimen No. 412, Book Binding. Certificate of Honourable Mention.

To Jos. Pitmackey, Philadelphia, for specimen No. 454, 1 Portfolio. Certificate of Honourable Mention.

Fine Arts.

To M. S. Parker, Philadelphia, for specimen No. 88, 1 Painting. Silver Medal.

To John Sartain, Philadelphia, for specimen No. 164, 2 frames—Mezzotinto Engravings. Silver Medal.

To Rembrandt Peale, for Portrait of Chief Justice Marshall. Certificate of Honourable Mention.

To Thomas Birch, Philadelphia, for specimen No. 93, 2 Marine Paintings. Certificate of Honourable Mention.

To John Haviland, Philadelphia, for specimen No. 715, Architectural Drawings. Certificate of Honourable Mention.

To John Gibson, Philadelphia, for specimen No. 414, 20 Imitations of Woods and Marbles. Certificate of Honourable Mention.

To W. B. M'Murtrie, Philadelphia, for specimen No. 481, 3 Paintings. Certificate of Honourable Mention.

To N. Monachesi, Philadelphia, for specimen No. 532, Painting of Charity. Certificate of Honourable Mention.

To Miss R. Sully, Philadelphia, for specimen No. 648, 4 Landscape Paintings. Certificate of Honourable Mention.

Fancy Articles.

To the Roxbury India Rubber Company, Boston, for specimen No. 266, Caoutchouc Cloths, deposited by J. Thornley & B. G. Mitchell. Silver Medal.

To the Pennsylvania Institution for the Blind, Philadelphia, for specimen No. 346, 24 pieces, deposited by J. R. Friedlander. Silver Medal.

To Miss S. W. Horn, Philadelphia, for specimen No. 389, 2 Shell Vases of Wax Flowers. Certificate of Honourable Mention.

To John Skirving, Philadelphia, for specimen of Scagliola. Certificate of Honourable Mention.

To Mrs. Bennett Fling, Philadelphia, for specimen No. 52, Shell and Wax Flowers and Fruit. Certificate of Honourable Mention.

To Mary Pastorius, Philadelphia, for specimen No. 814, 1 worsted Lamp Stand. Certificate of Honourable Mention.

To Louisa Miller, Philadelphia, for specimen No. 820, 1 Lamp Stand. Certificate of Honourable Mention.

Umbrellas.

To W. & W. H. Richardson, Philadelphia, for specimen No. 599, samples of Umbrellas. Certificate of Honourable Mention.

To W. A. Drown, Philadelphia, for specimen No. 119, a lot of Umbrellas. Certificate of Honourable Mention.

To Edwin Sleeper, Philadelphia, for specimen No. 245, Portable Umbrellas. Certificate of Honourable Mention.

Coach Making.

To Ogle & Watson, Philadelphia, for specimen No. 571, 1 Coach and 1 Buggy. Silver Medal.

To George Dunn, Newark, N. J., for specimen No. 706, Buggy Railing and Dasher. Certificate of Honourable Mention.

John C. Cresson,
William H. Keating,
Alexander Ferguson,
Thomas Fletcher,
Isaac B. Garrigues,
Alexander M'Clurg,
John S. Warner,
John Agnew,
William H. Carr,
Henry Troth,
Samuel V. Merrick,
Robert M. Patterson,
Committee on Premiums and Exhibitions.

EXTRACTS FROM THE JUDGES' REPORTS.

Report on Cotton Goods.

The Committee observe that the specimens coming under their inspection appear to have been selected from stocks remaining on hand from fall sales, now exceedingly low, and not to have been manufactured with a view to the Exhibition. Individually, in the pursuit of our ordinary business, we daily see manufactures of Cotton, at least equal, and some superior, to many of the articles exhibited; this, however, so far from detracting from the merit of the manufacturers, speaks highly in their favour. It shows that what formerly was exhibited as a curiosity, has now become a large and essential branch of the manufactures of the country, and is no longer looked upon with astonishment. The progress and improvement in substantial and serviceable goods, are very great, and in printed Cottons much excellence is attained; but while we congratulate ourselves on this result, we must not be blind to the fact, that much remains to be done. In the finer fabrics there has been but little attempted, and a wide field is open, as yet scarcely touched, among Cambrics, Jaconets, Mulls, Books, and the various kinds of light and fine texture goods. The variety of specimens exhibited was less than on former occasions.

Report on Woolen Goods.

The Committee take pleasure in saying that the samples submitted are generally entitled to commendation; the Cloths are well made, the colours good, and the finish of some of them very beautiful. Those samples which most particularly attracted the notice of the Committee were No. 270, a piece of Brown, and No. 520, 2 pieces of Drabs; perhaps 2 pieces of Drabs of lot No. 380, may be classed with them.

9 pieces of Cassimeres, No. 253, are entitled to praise; some pieces in this lot deserve very high commendation for colour, make, and finish.

The Satinets fully sustain the reputation which our manufacturers have heretofore acquired in producing this most useful article. Nos. 139, 254, and 486, are worthy of high praise both for excellence of material and skill in manufacturing. Nos. 140 and 141 are also excellent goods.

The samples of Blankets have been examined with peculiar interest and pleasure, particularly Nos. 256 and 324. Also a lot of cotton warp Blankets, which combine warmth with lightness, and appear to the Committee to be adapted to most of the purposes for which the woolen blanket is used.

Nos. 66 and 67, two excellent samples of Kerseys.

Report on Carpeting.

The Committee express with reluctance their unanimous opinion that no specimens of the Carpets, Floor Cloths, or Rugs, offered to their notice, surpass in excellence those in former Exhibitions, whilst in variety, style, and fabric, they fall far short of many patterns made in this country, and which, for the credit of American manufactures, it would have been well to have had exhibited on this occasion. The Committee are of opinion that the exhibitors have not brought forward their best specimens, and that due allowance must be made for the short notice given of the intended Exhibition, by reason of which they, and others, were prevented furnishing a more creditable display. No branch of American industry is likely to be more extensively patronized in the United States than that of making Carpeting and

Floor Cloths, the consumption of which is rapidly and widely extending. But whilst public opinion still leans in favour of imported goods, on account of early and well founded prejudices against those made in this country, owing to their greasy and imperfect character, and the many deceptions practised on those who were inclined to favour American ingenuity, it is but fair to state our united conviction that these articles can be, and are now, made in this country equal, if not, in some respects, superior, to those imported; and at our next exhibition it is to be hoped the public may have more ample proof of what can be done in this important and elegant branch of domestic industry.

Report on Silk and Lace Goods.

In performance of the duty assigned them, the Committee availed themselves of the valuable aid of Godfrey Weber, Esq., a gentleman whose long experience in the production and manufacture of Silk, entitles his opinion to great weight.

The Sewing Silks are very good; the Philadelphia article we consider entitled to the highest reputation, from its strength, evenness and colour. The Northampton is very beautiful, but rather deficient in strength. The Silk manufactured in Germantown we do not think equal to either of the descriptions above mentioned.

The specimens offered by Gertrude Rapp are worthy of all praise; the Black Silk Handkerchiefs (Cravats) are admirable, approaching closely in appearance to the Italian article. The Black Satin Vestings are highly creditable; the Figured Satin Vestings are deserving of praise, as fair imitations of the French article; this remark particularly applies to the small figure.

The White and White Printed Border Handkerchiefs, as also the Red Handkerchiefs, are very fair imitations of the English article.

The samples of Silk woven by E. F. Gay, are deserving of notice, the Gros de Tour is remarkably pretty, although too much Silk is employed to render the article profitable.

The cocoons vary greatly, the same lots embracing middling and superior qualities; those from S. Griffith and Sister are remarkable from the circumstance of their having been produced from the common black mulberry; it would be desirable in all instances to ascertain from what trees the cocoons are produced.

The Reeled Silk is equal in quality to the French or Italian; it is, however, unevenly reeled, mostly being single thread; for Sewing Silk it should be reeled from No. 18 to 20.

Report on Iron and Steel.

The Committee offer the following remarks upon the several articles which came under their notice.

A lot of Iron, manufactured by Valentine, Harris & Co., from the pig metal made at the Howard Furnace. The large round Iron, from the trials made, appears very good, and we think it would be better for the axles of rail-road cars, and other purposes requiring strength, than the English refined Iron, as it is much stiffer, and nearly as tough: the small round Iron from the same makers is also very good. The Slit Rods also, on trial, appeared to be of good quality.

Samples of Bar Iron, from the Martick Works, deposited by James Row-

land: the bars are beautifully hammered, and the Iron of good quality. If the forge masters in Pennsylvania could be induced to trim the fag ends of the bars, the same as the foreign Iron, it would be duly appreciated by all the workers in Iron, and make the article unexceptionable.

Blistered Steel, deposited by James Rowland, from the Kensington Furnace: a pretty good article, made from American Iron, but we do not consider it superior to samples that have been exhibited on a former occasion by the same gentlemen.

Some specimens of rolled and hammered Iron, made with coke, by Peter Ritner, the samples being so small, the Committee could not give them a fair trial, and therefore are not willing to express any opinion of the quality of the Iron.

Some Boiler Rivets, made by Canning & Co., of Troy, N. J., from the Howard Furnace Iron, said by those that have used them to be a very good article.

Specimens of Horse Shoes, Spikes, &c., made by machinery at the Troy Manufacturing Company's Works: the Horse Shoes especially appear to be well made, and the Iron good.

Specimens of Pig Iron from the Furnace, and also of the ore from which the Iron was made: the Committee cannot express a positive opinion of the quality of either of them, from mere inspection, no other means being at their disposal, although the appearance is certainly favourable.

Samples of Pig Iron made with anthracite coal, by Isaac C. Bryant & Co.: the same remarks will apply to these as to the preceding, and the Committee trust that the gentlemen engaged in this enterprise will persevere until they accomplish what they desire.

A Tuyere for a hot blast furnace, made by Savery Shaw & Co., Philadelphia, differing somewhat in form from, and allowed by those who have given them a trial to be preferable to, those in general use in Pennsylvania.

A quantity of Wire made by A. Denslow, from Juniata Iron, which is decidedly the best Wire, as to strength and appearance, the Committee have ever seen made from American Iron.

Report on Hardware and Edge Tools.

The Committee express their gratification at the general improvement in all the articles displayed. They notice particularly the Edge Tools made by William Beatty & Son; John Beatty; D. Simmons & Co.; Hunt & Co.; Taunton Manufacturing Company; Collins & Co., New York; and D. Stone. These are all of decidedly good shape and finish, and the Committee, where all were so good, found great difficulty in deciding as to the superiority of either. The Axes from Collins & Co. were all made in ten hours by one man; the Tools from Simmons & Co. and Hunt & Co. were not intended for exhibition: the others we believe were.

The Committee unanimously agree that the Saws from William Rowland are decidedly superior to any others ever exhibited.

The Forks from William H. Carr & Co. deserve more than a passing notice; the numerous improvements shewn by the samples must be apparent to every dealer in the article; the malleable cap for Hay Forks is an invention of Mr. Carr's; for this and the neat manner in which all are put together, we think Mr. Carr deserves the particular notice of the Institute.

A case of Cotton and Wool Cards; 1 of Tacks and Brads, from A. Field & Co.; box of Glue, and box of Coffee Mills: all good.

The Coffee Mills of Rittenhouse, a superior article, and the best exhibited.

Corn and Grass Scythes, from Rockwell & Hinsdale; ditto from Newton Darling; ditto from Hale, Whipple & Waters—all superior and much improved since last Exhibition.

Locks and Latches from Blake & Brother; good, and in great variety. Bank Lock by Wm. Heywood; good, and very strong. Locks by A. Prutzman, and by Jos. Nock; very ingenious in construction, and good. Trunk Locks by Jos. Nock, a new article, patented by the maker, the safest Lock of the kind known.

Locks and Butts, brass plated, from Rogers & Co., superior. Italian Iron, by Prutzman, good. A case of Locks from Day, Newell & Day, of New York, very safe, and, for finish and construction, the finest ever exhibited.

A Mortise Lock and Latch from the Nashua Lock Company; the simplicity of these articles, and their cheapness and durability, recommend them to particular attention.

Chisels from Russel, very creditable to the maker.

Case of Shoemakers' Tools, by M. Bates, best ever exhibited.

Vice, with Rack,
" with horizontal line screw, } Good improvements.

5 reams Sand Paper, from the experience of a number of our best mechanics, the best paper known.

Upper and lower Sash Springs and Fasteners; these attracted considerable attention, and are decidedly superior to any thing of the kind in use.

Aikin's patent Saw Setts; good articles, and very ingenious.

Report on Stoves and Grates.

The Committee were much gratified with seeing that so many, and such a variety, of specimens had been brought forward.

Of the Parlour Grates, there were some of very handsome patterns and good workmanship.

Kitchen Grates, or Ranges: there were two exhibited, completely and handsomely put up, in full operation, almost daily: both are well adapted for performing much work for the quantity of fuel consumed. The one by E. Barrows, of Philadelphia, has a boiler and baker in each side, and an oven in the back; the fire is contained in a cast iron cylinder, in front of which a large tin kitchen may be placed for roasting. Price, with all the necessary apparatus, put up complete, is $60. The fire being in a cylinder, a very small quantity of coal is necessary, and that of the cheaper kind, as nut coal, does well.

The other Range was from H. & F. Stimpson, of Boston; the fixtures are simple, easily understood and managed; boiler on each side; oven above the fire back; the heat may be directed to either or all at pleasure; the coal may be of the cheaper kind, as nut coal; grate open bars, and promises to be durable. The makers have three sizes, Nos. 1, 2, and 3, which are offered at $24, $34, and $40. Cost of putting up from $15 to $18. The smallest size, or No. 1, was exhibited; our citizens show a disposition to test its merits, as 100 are about being put up in this city.

Of Cooking Stoves for coal as fuel, there was a great variety; most of them were found to answer the purpose of the common 9 plated stove; the prices, sizes, and fashion are various, to suit the fancy of different persons

The Committee are much pleased to see the continual improvements making in castings of stoves, to obviate the necessity of wrought iron hinges, latches, &c., which makes them more durable, and at less cost, thereby increasing the comfort of even the poorest families, for the cost is so small, they are within the reach of all, and well adapted to the use of the lowest price small coal.

The Close Stoves, made of Russia sheet iron, for the warming of Parlours and Halls, such as the Olmsted, by S. Loyd; the 4 column Radiator, by Gleason, and others, are all very good, as the public will find by the use of them, that their houses may be warmed by them with less than half the coal consumed in open grates to give the same heat.

Report on Models and Machinery.

In so numerous a collection it was to be expected that many would be found possessing little interest either in the principles of their construction, or mode of application; the Committee, however, are happy to have it in their power to say that the proportion of such contained in the present display was unusually small, whilst, on the contrary, a number of machines of admirable execution, when the workmanship is considered, and great efficiency as it regards their operation, were before the public.

We have much pleasure in noticing the Locomotive Engine of Mr. Brooks; simplicity, compactness, and strength are united in an eminent degree in this Engine; the cylinder guide, one of its distinctive features, appears to your Committee to be particularly applicable in this instance from its strength, and the protection which it affords to the wearing surfaces from dirt; the strong and compact manner in which the pump plunger is appended is also worthy of notice; another most important part of this Engine is the means of reversing by a four way cock, and the peculiar and ingenious arrangement of the valves, by means of which this most important operation is rendered certain and rapid in the most desirable degree. In theory, and to the eye, no objection exists to this arrangement; in practice, difficulties may possibly arise, but the ingenuity which is every where displayed in the construction of this excellent engine, is quite adequate to meet them when they shall appear; indeed Mr. Brooks has, subsequently to the examination of the Committee, constructed a model to meet some of the supposed objections, with evident success.

The Committee suggest that the thanks of the Board of Managers are justly due for the careful and efficient manner in which he has supplied steam from the boiler of his Engine for the use of the other Engines and Models.

No. 11, Carriage Boxes, are well made, and worthy of commendation.

Fairbanks', and other, Counter Scales are well contrived and executed.

The models of Steam Engines, several of which were exhibited, are well executed, some of them remarkably so; they added materially to the interest of the Exhibition, and will form an excellent record of the progress of steam invention, especially if they could be collected and preserved in the rooms of the Institute.

The Spark Extinguishers for Locomotives, several of which were exhibited, need experimental trial; some are very simple, but the difficulty which is inherent in this desirable object, (the checking of the draft) does not appear to be overcome in any.

The Tailors' Measuring Machine, No. 144, has had a careful examination; by its aid a perfect fit could unquestionably be made, and it presents some

fixed principles by which certain distances, depths and curves, could be accurately measured. A skilful workman appears necessary to its employment; how far the same desirable result (a good fit) could be accomplished by the same hand, with simple tools, the Committee has not sufficient knowledge of the art to pronounce.

The Silk Reeling and Twisting Machines appear to your Committee to be important steps in the Silk manufacture. In the present state of their knowledge, they cannot speak of comparative efficiency or novelty in these particular machines, but they consider the advancement of this portion of our infant manufactures of the utmost importance, and recommend the subject to special favour.

It is within our memory that the cheap and good cottons of these States have taken exclusively the Eastern markets, from whence they were formerly supplied,—is it not probable that the same ingenuity applied to the manufacture of Silk, may produce a like result?

The Tailors' Shears patented and manufactured by R. Heinisch, deposited by Mr. Hawkins, are beautifully made, exhibiting, in the successive specimens, gradual improvement to a perfect fit to the hand, and a judicious disposition of the leverage; the Committee consider that a great benefit has been conferred on a large class of operatives by the improvement of an article in incessant use, and therefore recommend these Shears to special notice.

The Planing Machine, No. 331, is entitled to favourable notice; the manner in which the cutters are arranged is adapted to produce a smooth surface and a straight cut, and there are besides several ingenious modes of aiding the operation of the machine. The Committee are not sufficiently informed of the merits of other machines to report as fully on this as they would be otherwise induced to do; but it certainly possesses several important points of advantage.

The Fire Engines by Messrs. Merrick & Agnew, and Mr. Bates, are exceedingly beautiful, and quite well made; the former is of superior workmanship, and the ornaments are in good keeping.

Several very neat and well finished Steam Engines, of various powers, were exhibited; that made by Wm. M. Hartshorne, and employed, during the Exhibition, as the motive power for the various machines, was efficient and very useful; the thanks of the Committee would be well tendered to the maker.

Messrs. Sellers & Sons also deserve favourable mention for a handsome small Engine; but it is particularly due to Messrs. T. & M. Greer, to observe that their small horizontal Engine was remarkable for its simplicity, the guide and pump being combined, and also for its excellence of workmanship, being the neatest and most compact Engine yet presented. It possesses also additional interest from its being supplied with a tubular boiler.

The models of Row Boats are exquisitely beautiful in form, and of the utmost excellence of workmanship. This art appears, from these samples, to have reached its utmost point of excellence.

The Lathe and Slide Rest made by E. D. Marshall, is an excellent piece of workmanship, and in every part is well arranged and finished.

A number of machines were exhibited, which are not in the list furnished to your Committee, some of which are entitled to favourable notice. These machines were probably too late to be entered for examination, according to the regulations.

The Committee, however, take the liberty of appending to their report a notice of the following:

The Stave Cutting Machine by L. Lombard, was evidently efficient, rapid, and likely to be useful as a labour-saving and economical machine.

The Mortising Machine of Mr. Tompkins, is also worthy of commendation.

The Stave Sawing Machine of Mr. Moore, was also of particular interest, from its ingenious construction and adaptation to produce good work. It is worthy of special notice.

The Straw Cutter of Mr Green was also of simple and efficient construction; and the Stone Cutting Machine of Messrs. Jno. R. Post & J. Chritcherson is entitled to a favourable notice. The Committee are impressed with the importance of applying machinery to the cutting and dressing of stone, as one of the most important means of saving labour, especially in this State, where so many buildings are in progress, and where architectural taste is of so elevated a character. From the want of knowledge, they cannot judge of the comparative merits of this machine, but they think the object of its construction one of the most important, and worthy of the fullest encouragement.

Report on Lamps and Gas Fittings.

The Committee have great pleasure in saying that many of the articles submitted to their inspection do credit to American skill and workmanship.

The Lamps and Chandeliers of Messrs. Cornelius & Co., are designed and executed in a manner which, for taste and durability, has never been equalled in this country. Their style of bronzing (by a method believed to be new) struck the Committee as greatly superior to any thing of the kind they had ever seen. Some of the articles submitted by the same ingenious manufacturers are handsomely ornamented with etched figures. The Committee are not aware that etching on brass has, until now, ever been practised.

The different articles of Gas Fittings and Burners exhibited, manifest an improvement very creditable, more especially when we consider how recently that branch of manufacture has been introduced into this city. Those by Messrs. Whelan & Brown, although less finished than would be desirable for the parlour, are well adapted to general use. The burners by Mr. Saull are well made, but in a form, and on a principle, not found to be the best. Experience has shown that jets widely separated, besides the serious objection of wasting gas unconsumed, from negligent attendants omitting to apply the flame to each and every orifice, it is in other respects not economical. In all cases, jets should be so arranged (unless where ornament rather than utility is desired,) as to allow the flames to coalesce and form one sheet. By this means a much greater amount of light is obtained for the quantity of gas consumed.

The Gas Fixtures deposited by Mr. Hawksworth, came too late for competition, but are creditable for the smoothness of their workmanship.

The beautiful samples of Iron Gas Tubing, manufactured by Morris, Tasker & Morris, likewise came too late for a premium, though well deserving of it.

Report on Chemicals.

The Chemicals are from the laboratories of John Farr & Co., Wetherill & Brothers, and D. B. Smith & W. Hodgson. These gentlemen have long stood high as scientific chemists. The articles from them in the Exhibition

are deserving of commendation as excellent samples of their kind, but are such as have heretofore been manufactured successfully in this country; with the exception of Hydriotic and Formic Acids, and Sulphate of Manganese, from the last mentioned firm, which the Committee are not aware of having been made before by other American chemists.

The Fancy Soaps from the manufactory of Hyde & Sons, Baltimore, are of excellent qualities; and the Perfumery from the establishment of L. W. Glenn, deserves honorary notice.

The Varnishes from G. S. Clemens looked well, and the Committee have no doubt of their fine qualities, but had no means of effectually testing them.

Report on China and Glassware.

The Committee offer the following remarks upon the various articles submitted:

The samples of China very neat, but similar to that previously exhibited. The Committee regret to say that the manufacture of this article is discontinued.

The variety of Glassware being cut articles of various kinds from the Boston and Sandwich Company, is of a superior quality. The Committee are of opinion that this manufacture cannot be surpassed. The articles were of every day use, and deserve great commendation.

No. 203. The Stone Pitchers show a great improvement, and are fast approaching to the body and style of the imported.

No. 281. The Moulded Tumblers are worthy of consideration as being a new and superior article, possessing the appearance of cut, with a brilliancy of polish that gives it a very high character among the dealers in that article.

No. 337. The set of Fluted Decanters is considered by the Judges as being the very best articles of Cut Glass exhibited, both for quality of the metal, and beauty of the cutting. They recommend it to the attention of the Committee.

No. 611. The Committee, so far as their knowledge of the Crown Glass and Window Sash extends, consider it a superior article, and deem it worthy of consideration.

No. 663. This lot consists of various articles; the attention of the Committee was drawn to the magnificent appearance of two large Bowls: they are certainly very beautiful specimens of the perfection to which the art of cutting glass has been brought in this country.

Nos. 122 and 610. Very neat variety of cut and moulded Knobs.

There is exhibited several very neat samples of Britannia Castors, from several manufactories, said to be hardened with German silver. The appearance of these is almost equal to the finest plate. No distinction can be made as to quality.

Report on Marble Work.

The report of the Committee on Sculptures, Marble Work, &c., not being submitted in consequence of the absence of Mr. Peale from the city at this time, the following abstract may be received as a substitute for it.

Of the Marble Mantels, though all were meritorious, and some of those from Messrs. Findley Highlands, Vanderbilt & Wildes, T. W. Burchell, Henry C. Webb, and J. Struthers, were especially remarkable for the goodness of the workmanship, the Committee did not feel itself called on to recommend any one for the premium proposed. They were in fact specimens of the beautiful mantels usually made by those gentlemen, and for

sale at their establishments; not more excellent, either in design or execution, than the Committee have often found there. Of the tables and marble work generally, the same remark may be made. Two exceptions, however, require particular mention. The first, a Dial Stand of highly wrought Italian marble, on a plinth of Breccia from William Struthers, which, in their opinion, deserves the highest praise for its symmetry of form, purity of decoration, and exquisite finish:—to this, had the Committee had power, they would have unanimously awarded a premium. The other exception which they would record, is the tablet intended for the Monument of Joseph S. Lewis, Esq., a landscape carved in bas relief, including architecture, rocks, foliage, and water: this, though not absolutely finished at the time of the Exhibition, presented evident marks of the graceful chisel of Mr. John Hill, and proved that the same skill which directed the admirable sculpture of the Washington Cenotaph a few years ago, could be equally successful in its application to an entirely different class of subjects.

The Scagliola Columns, Pedestals, and Tablets, submitted by Mr. John Skirving, as they were among the most marked and beautiful of the productions exhibited, also obtained the careful attention of the Committee. They need not, in a brief report like this, attempt to give the history of this very ancient and long lost branch of artist-like manufacture. It is enough to say that Mr. Skirving has succeeded perfectly in introducing among us a substitute for marble, admirably adapted for interior decoration—and that he imitates the porphyry, the lapis lazula, the verd antique, and the several varieties of brown and yellow variegated marbles, so as to rival, if not, in some cases, to exceed, the beauty of the natural stone. A comparison of his work with some of the best specimens of European production, ancient and modern, would justify for him a claim of entire equality of skill with the celebrated manufacturers of other countries, and the low prices at which he furnishes this beautiful material in a finished state, must in a very short time introduce it to general use among us. The Committee strongly recommend the award to him of an extra medal.

On the whole, the Committee would remark, that in the department to which their attention was called, though with the few exceptions which they have noted, there was nothing to require specification; yet there were marks every where of progressive improvement in the style and character of the arts, and of a rapid advance towards perfection of manufacture.

Report on Books and Stationary.

Presuming that the various Bibles (they being the only printed books on the list) submitted were not intended as specimens of printing and paper, (for no particular point of merit was observed) attention has therefore been given to their exterior appearance as Books.

No. 382. An elegant Quarto Bible of exquisite beauty, the side inlaid with rich panel work. A superb 8vo. Bible, in red morocco, with panel work, richly gilt, and lined with satin. These two volumes are the most beautiful submitted, and warrant high commendation for taste in design, and skill in execution. The remaining volumes are well and handsomely executed, and the whole evince a great degree of improvement. The printing of the Oxford Bibles is well executed, and the paper of a good quality. The set of super royal Blank Books, richly bound in Russia, inlaid with vellum, and fancy ruled, are noticed as the most beautiful and carefully finished fancy Blank Books that the Committee have ever seen; the ex-

treme neatness of the ruling in 7 different colours, requires a degree of skill and care that has not been surpassed. The Medium Books, with patent locks, are neatly and tastefully bound, with ruling of extreme delicacy; they are worthy of notice for the fixture of a lock on the front, which is a security for the cautious, who are willing to submit to the inconvenience of its position. The set of plain bound books presents no particular point of admiration, but are neatly bound and ruled.

No. 382. The various article of Stationary are well made, and highly useful for the purposes intended, being of kinds now in general use, and sold by the various Stationers. They display an increased improvement in such articles, that relieve us from the necessity of importing them. The articles made by Mr. Ruthven are worthy of particular notice as being neat and well made.

The various specimens of Paper are of the kind and quality of fine papers now in general use, displaying an increased improvement in make and finish. They would particularly notice the Note Paper, No. 85, and other papers made by Jessup, being of superior quality.

No. 454. Port Folio, (in case No. 382) an article of rich and gorgeous beauty of mosaic work, a most attractive fancy article, executed in good taste.

No. 123. Lead Pencils of Jackson's well known make, and generally admitted as the best made in the country.

No. 414. Lot of Quills, well prepared, neatly put up, and good of the various qualities.

No. 652. File Presses, a useful article, well made, and neatly arranged.

No. 172. Two Books for the Blind, executed from type prepared by Robb & Ecklin, printed by Mr. Snider, at the "Pennsylvania Institution for the Blind," the one the Book of Proverbs, the other the Student's Magazine, a periodical published at the Institution, and containing original compositions for the pupils—well and neatly executed in every respect, and excites our admiration for the mental enjoyment thus prepared for an afflicted portion of our race.

No. 501. Two large Maps, of acknowledged geographical correctness, and of neat execution in the mechanical departments.

No. 614. Two Plans of the City and Districts, on an extended scale; in the printing, colouring, engraving, and mounting, neatly and handsomely executed; the whole presenting a pictorial effect.

Several other books attracted the attention of the Committee, which are not found on the list: among these may be mentioned a beautiful specimen of Law Books, "The Civil Code of Louisiana," executed, in all its parts, by Philadelphia workmen—the stereotyping by L. Johnson, printing by Collins, binding by R. P. Desilver, paper from Magarge's,—executed through the agency of S. M. Stewart, for Johns & Co., New Orleans—the handsomest law book within our recollection. Also, "The Gift," an Annual published by E. L. Carey & A. Hart, and executed solely by American workmen; beautiful, whether viewed in its engraving, printing, paper, or binding, and superior as a volume; displayed an increase in the improvement of such fine work.

Report on the Fine Arts.

Though limited in the number of its contributors, this department furnishes several proofs of superior merit: among these the Committee would particularize the fine portrait of Chief Justice Marshall, by Peale; Charity,

by Menachesi, (copy from a small original;) the Portraits and Fancy Pieces by Parker; Marine Views, by Birch; Domestic Animals, by M'Murtrie, pupil of the Academy of Design; Architectural Designs, by Haviland; Landscapes, by Miss R. Sully; Mezzotinto Engravings, by Sartain; Fancy Paintings, by Gibson, &c. &c.

Report on Fancy Articles.

The Committee on Fancy Articles beg leave to report, that they have examined each of the articles enumerated in the accompanying list, which they now return, with the following series of observations.

No. 157. The Pleasure Boat "Thought." Much praise is due to the builder of this truly beautiful and accurate piece of workmanship. Its extreme buoyancy, (for it weighs only 59 pounds, and draws, with one man seated in it, no more than two inches and a half of water,) combined with its strength, the excellence of its mould for cleaving the water, and the tastefulness of its finish, make it deservedly an object of commendation.

No. 216. Model of James' Life Boat—

This model of a very successfully planned Life Boat was removed by the depositor for the purpose of taking out a patent, and the Committee are unable therefore to make any further allusion to it.

No. 261. Specimen of Coach Painting—

This ornamental coach panel exhibits very considerable taste and skill in the design, and the delicate yet accurate manner in which the colours are laid on.

Nos. 266—268. Two lots of Gum Elastic Goods—

These articles which are manufactured at Roxbury, near Boston, recommend themselves strongly to favourable notice. They consist of gum elastic attenuated into thin sheets, and these sheets, in some specimens, cemented apparently by simple pressure to the printed surface of calicos, chintzes, engravings, maps, &c., and in others made themselves the ground upon which various coloured patterns are imprinted. The peculiar merit of these goods is in their retaining, in a perfect degree, all the original qualities of the gum elastic; its elasticity, its toughness, freedom from odour, and absence of all adhesiveness: the latter feature giving to this manufacture a decided superiority over any other preparation of the gum hitherto attempted. The attention of your Committee was particularly attracted to the beauty and evenness of texture of a shawl, consisting wholly of the gum elastic, upon which a very tasteful pattern had been impressed.

No. 310. Two cases of Flower Stands—

In neatness of form and execution, these articles, which are not merely ornamental, but very commodious, either in the greenhouse or elsewhere, are well worthy of commendation.

No. 336. A Lady's Work Box, with transferred ornaments—

Among the smaller pieces of fancy furniture, we noticed with pleasure the good taste and skill which had embellished a very neatly constructed lady's work box, with the transfer of some well-selected engravings.

No. 346. Twenty-four Articles from the Institution for the Blind—

For accuracy and fidelity of workmanship, these articles would do credit to citizens blessed with the assistance of sight. Neatness and excellence in the workmanship, distinguished them all. The specimens of twine and rope amply justify these remarks.

No. 389. Several Vases, some of Shell Work, some of Alabaster, containing Artificial Flowers in Wax—

Nothing in the entire catalogue of fancy articles, appeared to receive from the public a larger tribute of praise, or one better merited, than these admirably executed flowers in wax. For their close adherence to nature, their correctness of form, even in minutiæ, the exquisite beauty, delicacy, and truth of their colours, and the pure taste displayed in the arrangement of each superb bouquet, they will vie with the very finest specimens which this most tasteful art can furnish.

No. 405. Two pieces Fancy Work—

These struck us as possessing a very considerable degree of excellence, and as showing a good taste in the selection of the colours and in the workmanship.

No. 414. Twenty specimens in imitation of various Ornamental Woods.

Some of these specimens were in the form of centre tables, representing many different kinds of wood inlaid; others were imitations of portions of polished veneers, the painting being done on sheets of tin.

It is difficult to conceive any material advance in this branch of painting, beyond the point attained in these beautiful imitations of polished woods. In representing both the colours and the *grain* peculiar to each species of wood, the artist has been eminently successful, indicating a close attention to nature. We were much gratified at the beautiful and very faithful representation of a veneer of black walnut. So well painted was one of the centre tables in particular, that few of the many who gazed admiringly at it were aware that it was not a superior specimen of inlaid work.

The imitations of ornamental marbles, though in some instances well done, were on the whole much less happy efforts of the brush than those of wood here alluded to.

Two French panels, and an imitation of damask paper, for wall painting, were all very creditable specimens of good taste and skill.

446. A Silver Speaking Trumpet—

This specimen of the silversmith's art exhibited all the requisites of exact and delicate workmanship, with a just taste in the form and the embellishments of the instrument.

487. A lot of Anthracite Ware—

We would call attention to the neatness and good finish which characterized the specimens of anthracite ware. The usefulness of these articles, and their appropriate shapes and fine dark polish, place them high as ornamental pieces of furniture.

No. 565. Needle Work Stools—

These highly beautiful pieces of furniture represent, the one a dog, the other a deer, in raised needle work upon a ground of drab cloth, and both are remarkable for the rich effect of the workmanship, which gives token of the skill, taste, and patience of the artist.

587. Composition Vase—

This, which is a large vase of some species of stucco, painted, and sprinkled with fine sand, to imitate a light gray sandstone, is of truly classic model, and as an article of ornament for a hall, is well deserving of approbation.

592. A Cane consisting of many Joints of several kinds of Wood, screwed together—

Considerable praise is due to the neat and ingenious artificer of this very pretty cane. The accurate workmanship in it is much to his credit, but the feature especially deserving of encomium is the soft and exquisite polish imparted to the surface, not by varnish, but by rubbing in some fluid by the

aid of simple friction. This mode of bestowing a polish on wood is much in vogue in France, where it is made to supersede the use of varnishes, almost entirely, in some descriptions of furniture. By displaying the natural fibre of the wood in all its beauty, and clothing the surface with a soft and mellow polish, wholly devoid of glare, it recommends itself to favour, beyond any other mode of embellishing and preserving ornamental wood work.

No. 715. Flowers, worked in worsted, by Miss Sally Ann Fling—

The selection of the colours, and the softness and grace in the delineation of these flowers in needle work, evince a cultivated talent in the fair artist by whose hands these beautiful bouquets were wrought.

In another apartment, we gazed with much satisfaction upon an elaborate picture, in needle work, of Fairmount and its environs, by Miss Parkinson. There is really much to commend in this piece, in the elegance and neatness of the handywork, while its accuracy as a likeness of a well known and cherished scene, makes it a most pleasing performance.

No. 814. Worsted Needle Work, by Mary Pastorius—

We are disposed to rank this specimen of needle work, and also another, No. 820, by Louisa Miller, as among the best executed pieces of the kind in the whole exhibition.

No. 786. Landreth's Garden—a Perspective Model—by a Lady of Philadelphia, deposited by W. L. Pitfield—

A more pleasing specimen of this kind of workmanship we have rarely seen. Its fidelity in the smallest details of form, colour, and perspective—the greatest merit in this species of model—is truly remarkable, and the whole betokens a true taste, and gives evidence of no small amount of skill.

Report of the Committee of Arrangement.

To the Committee on Premiums and Exhibitions of the Franklin Institute.

The Committee of Arrangement for the Tenth Exhibition respectfully Report:—

That, in execution of the arduous duties undertaken by them, they have endeavoured, from their first organization until the successful close of the Exhibition, to discharge acceptably the task assigned them. The readiness and unanimity with which this task has been fulfilled by the various subcommittees, and the general good feeling which has prevailed among the visitors and contributors of the Exhibition, during its whole course, are sources of great satisfaction, and particularly to those who have been most emulous to gratify public expectation. Some reasonable fears were started that we should not, with so short a notice as we had, be able to accomplish all that was expected; but these fears were converted into assurances the most flattering, that the public, as well as the members of the Institute, have been equally disappointed in the extent, variety and arrangement of the Exhibition; and we may, therefore, now give up our posts without self-regret, hoping that others may fill our places hereafter with more confidence in themselves, and satisfaction to others. Before parting with each other, however, and with the view of offering the result of our experience to those who are the more immediate guardians of an institution than which none in this country is more devoted to the best interests of the community, where progressive improvement in the arts is the main-spring of our national prosperity, we take leave to suggest the four following hints.

In the event of another exhibition, which we think should not be sooner than 1840, a strong appeal should be made to our citizens to provide a more commodious building, and one better lighted and ventilated, than the Masonic Hall. An earlier notice, and more ample time for procuring and arranging the specimens for the Exhibition, would be desirable; and, as no period of European history can furnish a parallel to the intense activity, laborious enterprise, and productive ingenuity which now distinguish the American people, it will be proper to make arrangements for exhibiting the vast improvements in the arts and manufactures resulting therefrom, on a scale commensurate with their importance. Spacious as the Masonic Hall is, there was not space enough in all its rooms to arrange properly all the specimens already presented, and when the intended School of Arts is established, we may expect a much larger display.

In connexion with this School, which we doubt not will soon be sustained by the wisdom and liberality of our Legislature, it will be a benefit to the country, but more especially to our own state and this city, if the Franklin Institute may possess every means of maintaining the primary stand it now holds among the promoters of public improvement; but without the aid of commodious halls for lectures and exhibitions, so situated that the public may patronize them, other cities will soon have that precedence which is now due to our own. We hope, therefore, that prompt and vigorous measures will be taken by the Managers of the Institute to have another and more suitable building erected on the site of the Masonic Hall, so that we may not be constrained to present an iron face towards our patrons, nor devote the profits of the Exhibition to temporary expenditures.

The general arrangement in regard to Exhibitions, we think susceptible of some improvement, and, with proper deference, we would now suggest that a primary committee should be formed early to consist of the Committee on Premiums and Exhibitions and the several Chairmen of the various Sub-Committees of Arrangement, and that one of the Committee on Premiums and Exhibitions should always be in attendance during the Exhibition, and, if necessary, act as umpire. By thus acting in rotation, there would be some one to decide always on any subject requiring a decision among the committees or depositors.

The continuance of the Exhibition we think should not be less than a fortnight, and distant contributors should have ample notice of every facility given them to forward their goods or machines, and premiums be awarded to the most deserving, notwithstanding they may have received them from other societies.

All which is respectfully offered.

For the Committee of Arrangements.

C. C. Haven, Chairman.

Philadelphia, Nov. 23, 1838.

Physical Science.

The following communication was received too late to be inserted in its proper place, but as the writer was desirous to have it published in the same volume with the article to which it is a reply, the Committee have judged it better to place it thus out of order, than to postpone it to the next volume.

Com. Pub.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Remarks on Mr. Espy's Theory of Centripetal Storms, including a Refutation of his Positions relative to the Storm of September 3rd, 1821: with some Notice of the Fallacies which appear in his Examinations of other Storms. By W. C. Redfield.

The practical importance of the investigations which relate to the character and courses of our great storms, will be deemed sufficient apology for this communication.

Early in the year 1831, an article on storms appeared in the American Journal of Science,* the main objects of which were, to point out the relative or whirling character of the great storms which visit the Atlantic coast, their origin in the intertropical latitudes; the circuitous or semi-elliptical character of their several paths or orbits; the general uniformity of their courses through the tropical and temperate latitudes; and the obvious cause for the continued depression of the barometer which is found in the centrifugal influence of their rotary action.

In drawing up this paper, I deemed it not inappropriate to exhibit the origin of the views or conclusions therein maintained; they having been first suggested by extensive personal observations of the phenomena of the storm of September 3d, 1821, in the states of Connecticut and Massachusetts, and confirmed by numerous personal inquiries, made at that period, of ship masters and other intelligent persons who had observed its action. I also added, in a very condensed form, such marine reports relating to this storm as appeared to afford further information. My statements, as then published, were copied extensively into the newspapers of the day, and had a wide circulation among the intelligent inhabitants of New England, who had witnessed the effects of this storm; and, so far as I know, their general accuracy has never been called in question.

Having shown the origin of my investigations, I proceeded to a more particular statement of the phenomena which were exhibited at various localities by the north-east storm which visited New York on the 17th of August, 1830; showing from an extensive collation of facts, its whirlwind character; its identity with the hurricane which visited certain islands in the West Indies five days before; its course, daily progress, and uniform character during this period; its further progress to the Banks of Newfoundland; and also its absolute identity with the E.N.E, S.E., S., S.W., and north-westerly gale which prevailed off this coast on the 17th, at or near the time when the gale was blowing at N.E. at New York and its vicinity. These results, which, for the most part, appear not to have been previously sus-

* Silliman's Journal for April, 1831, vol. xx., p. 17—51.

pected, have been more fully generalized and illustrated in subsequent papers: and are also exhibited, in a most convincing manner, in the highly valuable work of Col. Reid on the Law of Storms, which has lately been published at London.

It appears, that since the results of the above inquiries have been brought before the public, Mr. Espy, of Philadelphia, in considering the laws of aqueous condensation, has been induced to believe that he has discovered the true cause of winds and all the various phenomena of storms which occur in our atmosphere.* This theory, which he has set forth in a series of essays in this journal, appears to have formed the basis of his reports as chairman of a joint meteorological committee of the American Philosophical Society and the Franklin Institute.

The type of this new theory, or of the manner in which it is supposed to be exemplified, it is believed may be found in the movements of the air in a common chimney, or bonfire: but it appears to find little or no support in the facts which have been brought to notice during my inquiries into the phenomena of the Atlantic storms. Encouraged, however, by plausible, but erroneous inductions, made from the phenomena of the New Brunswick tornado in June 1835,† and by friendly, though perhaps injudicious support and announcements from highly respectable sources; and aided also (with few exceptions) by the favour and guardianship of the Philadelphia press, Mr. Espy has continued to labour with assiduity for the establishment of his theory.

In a brief introduction to his essays in April, 1836, Mr. Espy announced that "he had collected such a mass of facts as would place his newly discovered theory on an immovable foundation;" and that his readers would find developed in his essays "a law" which explains at once "all the *seven* phenomena of rain, hail, and snow, water-spouts, land-spouts, winds, and barometric fluctuations.‡"

Of the manner in which this modest announcement has been sustained, and of the apparent errors or misapprehensions of facts and of the principles of science, which abound in these essays and subsequent papers, I forbear at this time to make inquiry. But in one of these essays, (August, 1836, p. 105—108,) he gives a constructive abstract of my account of the storm of 1821, which abstract is then claimed to be inconsistent with a horizontal whirlwind, and he adduces these constructive phenomena, as "proving with irresistible evidence the existence of an upward vortex in this storm;" meaning here, by a vortex, not a gyrative movement, but a chimney-like motion.§ He also treats as an unwarranted conclusion, the observed fact, that "*along the central portion of the track, the storm was violent from the south-eastern quarter, changing suddenly to an opposite direction.* Disregarding, also, an important portion of the evidence, he then proceeds to assert, without, however, offering any proof, "that it was on the S.E. side of the storm at which the wind set in S. of E.," and further, that he could not find that the wind had changed from the S.E. to the N.W. quarter, as I had represented.

To this effort to set aside the results of my observations and inquiries, I

* Jour. Frank. Inst. vol. xvii., p. 240 vol. xxiii., p. 153, &c.

† Some incidental remarks on this tornado will be published in the June number of this Journal.

‡ Journal Frank. Inst., April, 1836, vol. xvii., p. 240.

§ Ibid, August, 1836, vol. xviii., p. 105.

replied in a communication which appeared in this Journal for February, 1837; (vol. xix., p. 112—127,) to which the reader is now referred.

It must appear obvious, however, to Mr. Espy, that the action of the Atlantic storms, as developed by my own inquiries and those of Col. Reid, cannot be reconciled with his supposed centripetal movement of the winds, *even for hundreds of miles*, in nearly right lines from all sides towards the centre of the storm:* and hence the renewed attempt which we now find in the March number of this Journal, to invalidate the facts which I had adduced, and to obscure or pervert their plain and obvious bearing.

In the freedom and candour of these prefatory remarks, it is by no means intended to impeach the sincerity or integrity of Mr. Espy, in any of his strictures or positions: but the strong bias which has apparently resulted from having preoccupied his mind with the speculations which he connects with his favourite theory, causes him to "suspect" every fact or conclusion which militates with his cherished conceptions, and to press into his service nearly all the heterogeneous phenomena in nature. This seems to disqualify him, at least in a measure, for instituting a rigid and impartial system of inquiry, suited to the present state of knowledge, and to the obvious demands of his assumed position, as a reformer in meteorological science. It appears to have been the misfortune of Mr. E. to have commenced his labours at the very point where, if successful, they should have terminated; viz. in establishing a general theory of atmospheric physics, resting on the basis of observation and strict induction in every class of natural phenomena which are sought to be comprised in his system. The attempt to explain nearly all the physical phenomena of the atmosphere by the theory of aqueous condensation, is not unlike that of him, who, in essaying to climb, should commence at the last and highest step in the ladder. In so diffuse and complex a science as meteorology, it is not by this inverted Baconian process that we can expect to "ascend from effects to their causes."

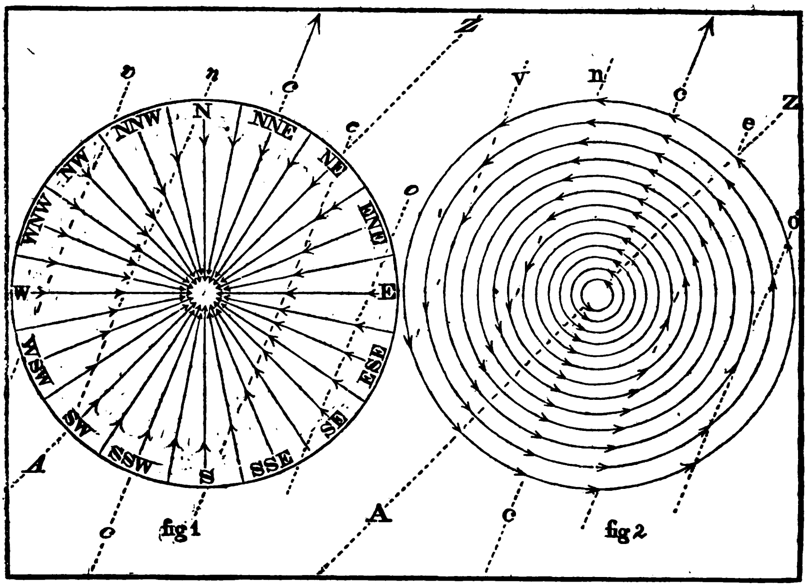
I have already glanced at the physical impracticability of a centripetal movement in the atmosphere, over a surface of several hundred miles in diameter, towards the centre of a storm; where, instead of the accumulation which must inevitably result from this movement in the air, its state of diffusion is known, by the indications of the barometer, to be unusually increased. But, for the purpose of examination, we may assume the theory; and we may then expect that when a storm moves along the coast of the United States, from the tropical latitudes, the wind, *on the centre of its path*, will set in from N.E., and so continue till the centre of the storm itself shall arrive, when, after a short lull, or a very rapid change, it must change to S.W., and blow in this last direction to the end of the storm; while, on the N.W. border of the centripetal storm, it should *commence from nearly N.W.*, and be of comparatively short duration, and showing little change in its direction.

But, on the contrary, if the storm be of a whirlwind character, and revolving to the left around its own central lull, or axis, then, if regularly exhibited, the N.E. wind at its commencement must pertain to the left hand

* It should here be kept in mind, that half of the entire atmosphere lies below the height of three and a half miles. I have also good reasons for believing that the entire masses of our storms lie beneath this comparatively small elevation. What space for the exhibition of a vast centripetal column, whose semi-diameter is even imagined to have extended, in one case, from Iceland to Italy! See Journ. Frank. Inst. Oct. 1836, vol. xviii., p. 241, 242.

portion of the storm, (N.W. of its centre) and, as the storm advances, will change by the N. to the N.W. quarter. While *on the centre of its path*, the wind must set in from near to S.E., *blowing across the track of the storm*, and when the axis, or lull, has passed, the wind will be found in the N.W. quarter, blowing across the track of the storm, in the direction opposite from the commencement: and in places near to which the lull of the storm may pass, the wind will veer round, more or less suddenly, in proportion to the distance, towards the direction which is opposite from its commencement.

For the illustration of these positions, I refer to the annexed figures, the first of which illustrates Mr. Espy's centripetal theory, as applied to the storm of 1821; which, in the latitude of Philadelphia, was moving nearly N.N.E., as indicated by the line and arrow head *c, c*. Fig. 2 illustrates the rotary or whirlwind theory as applied to the same storm; which, in its advance, would be intersected by the several geographical stations, *v, n, c, e, o*, on the several lines of arrow heads which are found in line with these stations on both figures. The direction of the several arrow heads represents the direction, as well as the order of changes, which the wind would present to an observer, at each of these stations, according to the two theories.



A supposed variation of the course of the storm, and of the lines of intersection on the two figures, to N.E., parallel with the lines A, Z, may serve to illustrate the application of the two theories to storms that move in a N.E. direction, which is their more general course in these latitudes.

The foregoing remarks and illustrations are deemed necessary for a right understanding of the subject before us.

The positions of Mr. Espy which I propose at this time to refute, are found in his Examination of Col. Reid's Law of Storms; in a portion thereof

which he states to have been written in his official capacity as meteorologist of the joint committee at Philadelphia, but not accepted by the committee. He here proposes to "demonstrate" that the storm of Sept. 3d, 1821,* was not "exhibited in the form of a whirlwind, but was like the twelve storms which have been investigated [?] by the joint committee of the American Philosophical Society and the Franklin Institute, that is, that the wind blew inwards at its borders." He says, "this conclusion is rendered certain by the following facts, [allegations?] which are deductions from the particulars given below."—We shall see.

First position. "The storm set in every where on the extreme S.E. border from the S.E., and not from the S.W., and changed round to the S.S.W. or S. And on the extreme N.W. border it set in from N.N.E., and blew hardest from the N. and N.W. Now, on the extreme S.E. border, it could not blow from the S.E. at all, on the supposition it was a whirlwind; nor, on the N.W. side, could it blow at all from the N.W. Both facts, however, are not only consistent with a centripetal motion of the air, but absolutely prove it." p. 149, March number of this Journal.

That by the "extreme S.E. border," is here meant the extreme outward limit of the storm in that direction, is evident; for, assuming, as he appears to do, that the course of the storm was N.E., it is only upon "the extreme border," according to his own theory, that the storm could set in at S.E.; and because the position would otherwise be destitute of any discriminating value.

We begin with the two positive allegations: 1st, "The storm set in every where on the extreme S.E. border from the S.E.;" and 2d, "On the extreme N.W. border it set in from N.N.E." From the evidence recited as supporting the alleged facts, we find a wide portion of the central track of the storm on which it is reported as beginning at S.E., viz: from the coast of Maryland, and New Jersey, and thence on a line through Bridgeport and Middletown, Conn., on one side, to an unknown point off Cape Hatteras, and a line drawn from thence, at a distance from the coast not well ascertained, but passing perhaps through the towns of Providence and Boston on the other.† Now, what evidence has Mr. Espy adduced, that the easternmost general limit here alluded to, was "the extreme S.E. border of the storm?" On this supposed limit, we find the storm raging with violence, and this wind could not here have sprung instantaneously into action, but must have swept from a greater distance, though doubtless with a diminishing force and modified direction, as it became more remote from the axis of the storm.

But we are not left to this obvious conclusion: for we find in the evidence adduced, that "a vessel from Bermuda experienced the gale from the westward on the inner edge of the Gulf Stream." Probably from the S. W. quarter, i. e. *westward of the meridian*, a colloquialism common with nautical men; and on any construction, this statement alone refutes the position.

We find, 2d, "in lat. 38° 30′, on the inner edge of the Gulf Stream, *gale from the westward.*" This also agrees with the foregoing, and disproves the position.

* Journ. Frank. Inst., March, 1839, vol. xxiii., p. 149—158.

† It is my own opinion, that the S.E. wind was not found eastward of a line passing through New London and Worcester, but newspaper reports have given the direction at S.E. in general terms, to the extent here mentioned, where I suppose the storm was S.S.E. nearly, or at best S.E. by S., in the early part of the gale.

3. We have also reported in lat. 38° 30′, lon. 74° 30′, gale S. by E. Whether this longitude be printed correctly or otherwise, this report contradicts the position. It is true also that we find "a ship from Boston to Norfolk [Bristol Trader, three days out,] in lat. 40° 19′; weather foggy, and light winds from S E;" but she had met with head winds, and judging from the position of Nantucket shoals, it appears not probable that she was westward of their meridian, and she may have been much further to the eastward:* and to assume a direct connexion and identity of these exterior "light winds from S.E.," with the S.E. gale in Connecticut, is assuming the very point which is necessary to be proved; and such a conclusion, it will be seen, is contravened by other facts.

I now submit further evidence, to show that the border here claimed was not the extreme border, and also, that as we proceed from the centre of the path of the gale towards its eastern border, it was found to commence from a point southward of S.E., which could not happen according to Mr. Espy's theory, as may be seen by referring to fig. 1.

4. We have accounts of the gale eastward of the Bay of Rhode Island, and in Bristol harbour a vessel was driven on shore: probably not by a S. E. wind.

5. The ship Camillus, Peck, from Greenock, which arrived at New York on the 7th September, *experienced the first part of the gale from S.S.E.*

6. Schooner Juno, Low, from Aux Cayes, reported at Salem, September 5. On Monday morning, Sept. 3d, saw a dismasted vessel, eight leagues E. of Cape Cod. *Had a heavy blow on Monday night, at S.S.E.*, and a very high sea running.

We thus see, in part from Mr. Espy's own evidence, that his "extreme S.E. border" of the storm is a mistaken assumption, and that his extreme S. E. wind (which, upon his theory, should have been E.S.E., as the course of the storm in this latitude was nearly N.N.E.,) has been already traced round to S S.E., and, could the inquiry be carried out, I have no doubt we might follow it round to the westward of the meridian, as experienced by the vessel from Bermuda.

We proceed now to the supposed "extreme N.W. border," where it is alleged that the storm "set in from N.N.E." I might, however, rest contented with this allegation; for the admission that the storm here set in from N.N E., i. e. in the direction which is contrary to the progress of the storm, is in strict accordance with the whirlwind theory, and fatal to his own, which would here require the wind at W.N.W., or nearly; while his N.N.E. wind should be confined *to the centre of the track*, and yet Mr. Espy here makes the unfortunate assertion, that such facts as this are not only consistent with a centripetal motion of the air, but absolutely prove it!

The only places I find mentioned where the gale is said to have set in at N.N.E., is in one of the reports from Norfolk, and another from Bombay Hook, near the head of Delaware Bay, from both which places the other accounts say N.E.; but in one of these points of direction, (N.E.) Mr. E. has fixed the centre of the storm, and the gale was heavy on this line of track: how, then, does he find here "the extreme N.W. border?" But more of this as we proceed.

* This last supposition appears not only probable, but almost certain, from this fact, that the ship Camillus, from Greenock for New York, was up with Nantucket about three days before the gale, but was unable to get to the westward if not driven back; so that she took this gale at S.S.E., and did not then arrive till the 7th.

Second position. "Wherever the wind set in from the E., it always changed round by the S., which is consistent with the centripetal, and inconsistent with the centrifugal, theory." p. 149.

The entire want of arrangement in the facts collected by Mr. Espy, somewhat impedes the inquiry; but on examination, I find mention of only three places where the gale is said to have set in at E., viz. off Roanoké; in some of the accounts from New York; and in a letter from on board steamboat Connecticut, which went that day from New York to New Haven. Of these, the report from Roanoke represents the wind not as changing "round by the S." but first at E., and then S.W. At New York also, no mention is made of a change from the E. round by S. The "wherever" would appear, therefore, to be found only at, or near, New Haven. Here, it is true, the wind "changed round," not from E., but from S.E., "by the S.," *as it should do*, (except on the line of lull,) *according to both theories*, (see figures.) Intelligent friends, (one a ship master,) then on board the Connecticut, assured me that the gale here set in nearly from S.E., and hauled somewhat suddenly to the S. and S.W., (owing, as I suppose, to the near proximity of the lull at that time,) and by this change the Connecticut was driven from her anchors and cast on shore at Morris' Cove, East Haven. It was within my own observation, also, that trees prostrated by the first part of the gale in New Haven and its vicinity, pointed, not to the W., but N.W., or more northerly, showing a S.E. or S.S.E. wind, and numbers of these indubitable records remained in this position for years, some nearly to this day. The observations made at New Haven, for the Connecticut Academy of Arts and Sciences, (and furnished to Mr. Espy by Mr. Rich, now a member of Yale College,) also fix the wind at S.E. Nor does it appear, on any theory, how the wind could have been more eastward at New Haven, than at Bridgeport and Middletown, where the printed reports state it to have been S.E. The position, therefore, fails.

Third position. "There never was a lull mentioned, only where the wind set in from the N.E., which has the same bearing as before, for the centre of the storm only can have a lull." p. 149.

Let us try this allegation by the evidence then before Mr. Espy.

1st. In the marine reports, from localities where the gale set in from S.E. to E., we may rightly infer the presence of the lull from the phenomena which are expressly mentioned. As, off Roanoke, "a dreadful gale at E.,* *then S.W.*," (p. 153) for we know that the gale seldom shifts to nearly the opposite quarter, without an intervening lull. Again, at sea, 40 miles N. of Cape Henry, severe gale from S.E., *changing to N.W.*" The last remark applies still more strongly to this report. To which I may add as positive evidence, (not, however, then before Mr. Espy) that a shipmaster, whose vessel was driven on shore to the southward of Cape Henlopen, with the wind "right on shore," also described to me the sudden lull, and the ensuing blast from W.N.W. Also, the schooner Mark Time, from Norfolk, (New York Gazette, September 7,) experienced the gale from S.E. off Chincoteague, Md., *was thrown upon her beam ends*, and remained an hour in that position, when *the shift of wind to the westward righted her.* This vessel would hardly have lived so long in this position, except she had fallen into

* It should be noted, that an E. wind in this part of the track, where the course of the storm was nearly N., corresponds, in the character of its changes, to an E.S.E. wind in the latitude of Philadelphia, where the course of the storm, or the curve of its track had changed to nearly N.N.E.

the lull, and being righted by the sudden shifting of the wind, might fairly imply, that after the lull, it had suddenly come out from the opposite quarter.

2d. "At Cape Henlopen, Delaware, the hurricane commenced at half past 11 A. M, *from E.S.E*; shifted in 20 minutes to E.N.E., and blew for nearly an hour. *A calm of half an hour succeeded*, and the wind then shifted to W.N.W., and blew, if possible, with still greater violence," p. 154. Here, certainly, is mention of a lull, and no mention of a N. E. wind.

3d. The National Gazette, adduced by Mr. Espy, states: "At Cape May, from 1 P. M. till half past four, the wind blew a violent hurricane from S E.," p. 158; and my own reports (p. 154) state that the gale here "commenced at N E. at 2 P. M., and veered to S.E., and blew with great violence,—*after abating* 15 *minutes*, it again blew with increased violence for two hours, and then abated." The direction of the wind, after the lull, is not stated, but being the close of the storm, it was doubtless from the westward, as at Cape Henlopen, which is distant but 13 miles, and nearly in the line of the storm. Here is the only pretence which I can find for connecting the lull with a N.E. wind, which the collation of accounts shows to be an error, or at best only an incipient wind at Cape May, and not the true easterly wind of the gale. But further:

4th. "This storm, as experienced in the central parts of Connecticut, commenced blowing violently from E.S.E. and S.E. about six o'clock in the evening of the 3d day of September, having been preceded by a fresh wind from the southern quarter, [from S. or S.S.E.,] and flying clouds. It continued blowing in heavy gusts with increasing fury, till about 10 o'clock, P. M., when the wind suddenly subsided. A calm, or *lull*, of perhaps fifteen minutes duration ensued, which was terminated by a violent gust from the N.W., which continued till about 11 P. M, and then [i. e. from that time,] gradually abated." (Silliman's Journal, April, 1831, vol. xx., p. 20.) This (which lay before Mr. Espy) was the testimony of an actual observer, who resided on the ground, was familiar with the points of the compass as connected with the winds, from his boyhood, and had the best possible reasons for knowing the direction and strength of this gale; who had then formed no theories on the subject; who for months, and even years, afterwards, had also before him nature's own records of the direction of the wind, as exhibited in the prostration of the orchards and forest trees; and who is perhaps the only person living who made extensive and careful observations and inquiries on these points at the period of the storm.

Of the surprising character of this allegation, "that there never was a lull mentioned, only where the wind set in from the N.E.," it does not become me to speak; but I infer that Mr. Espy has here drawn mainly upon the centripetal image existing in his own mind, rather than upon the recorded observations which lay before him.

Having thus shown the error of this statement, and that the lull was on or near the line of S.E. wind, and as Mr. Espy also here admits that the centre of the storm only can have a lull, it appears to follow that "this storm *was* exhibited in the form of a great whirlwind," as I had previously maintained; for the point here discussed, involves the main question between the two theories.

Fourth position. "Where the wind set in from the S.E., there is no lull mentioned previous to a change of wind, and in no instance could I find that it changed round to N.W. Two instances are given by Mr. Redfield, one at Bridgeport, Conn., which I find is incorrectly reported, [?] and instead

of changing round to N.W., it should read S.W.:—the other at sea, 40 miles N. of Cape Henry; this I could not find, and I suspect there is something wrong in it, for 40 miles N. of Cape Henry is not at sea, but in the eastern shore of Virginia. [!] At other places in a right line with this, it set in from the N.E., e. g. at Cape May and Norfolk." p. 149—150.

The first assertion here, that "where the wind set in from the S.E. there is no lull mentioned previous to a change of wind," is refuted by the facts just reviewed; this being a reiteration of the foregoing position in another form. But he here says: "*in no instance* could I find that it [the S.E. wind] changed round to N.W." The value of this extraordinary assertion has also been seen.

Unfortunately, it appears that two of my cases have been "*suspected*" by Mr. Espy as being contrary to his theory.* We have before heard of his finding of the error at Bridgeport, where, by his showing, "the wind commenced blowing hard from S.E. about 6 P. M., and continued to increase in violence *till about* 9 *P. M.*, [the italics are mine] when the tempest raged with a degree of fury the most awful and destructive. The storm continued with unabated force until near 11 P. M., when the wind hauled round to S.W., and gradually abated."

I see nothing in this account to support Mr. Espy, except the obvious omission to state the direction of the wind from 9 to 11: for we know that the centre, or axis, of the storm, which, from the indications of the barometer, we find to have been opposite to New York at 7h. 30m. P. M.,† must have passed Bridgeport at, or soon after, 9, about the time which my information fixes the change at New Haven, and was at Middletown and Hartford about 10; and immediately after this crisis of the gale, the wind is known to have been blowing from the N.W. quarter on all this line. Neither have we any reason to doubt the account from which my own statement was taken. After 11, i. e. two hours *after* the passage of the centre of the storm, "the wind hauled round [from N.W.?] to S.W., and gradually subsided." My own knowledge, and inquiries made at the time, corroborate this view of the facts.‡

The observations made "at *sea*, 40 miles N. of Cape Henry," it appears are set aside, because that 40 miles *due* N. of that Cape is on land, "in the eastern shore of Virginia"! This is quite unworthy of Mr. Espy and of his cause; for who did not perceive, that by this phrase was meant, 40 miles from Cape Henry, on the usual route of vessels bound northward. On this subject I find the following:—

Norfolk, Sept. 9th, 1821. Arrived, sloop Atalanta, Philips, of Swansey, bound to Charleston. August 26, off Cape Hatteras, close in with the land, experienced a severe gale from S.E., which split her sails to ribbons, and made it necessary to put into the first port. On the 3d instant, about 40 miles N. of Cape Henry, experienced another severe gale from S.E., which hauled round soon after to N.W., which made the A.'s situation so embarrassing, that it was with difficulty she could be got in.

* Journ. Frank. Inst., August, 1836, p. 105. I quote the italics.

† In the New York American, Sept. 4, I find the following facts communicated relating to the state of the barometer in this storm; at 6 A. M. 30.13—2 P. M., 30.05—6 P. M., 29.62—7.30 P. M., 29.38—8 P. M., 29.53—9 P. M.; 29.64—10 P. M., 29.07—the last, evidently a typographical, or a clerical, error.

‡ From the best estimates which I have been able to make of the course of the lull or centre of this storm, it would appear to have crossed Stratford Point and Milford, on the N. shore of L. I. Sound, passing between Bridgeport and New Haven, and perhaps nearly touching one, or both, of these places.

The worthy captain of the Atalanta, and his marine reporter at Norfolk, will doubtless be surprised on finding that the reported position of this vessel was "not at sea, but in the eastern shore of Virginia." The reader, however, will here perceive at least one other instance in which the S.E. wind *did* "change round to N.W."

It is strange enough that the "right line" of N.E. wind should have been located through Cape May, where, according to Mr. Espy's own showing, from the National Gazette of September 7th, "from 1 P. M. till half past 4, the wind blew a violent hurricane from S.E." p. 158. Instead of this, we find this line to have been through Edenton, Norfolk, Chesapeake Bay, Bombay Hook, and New Castle, Philadelphia, Trenton, and New Brunswick; at all which places, instead of a lull and opposite gale, the storm veered to N.W. I see nothing left, therefore, of this position.

Fifth position. "Along the seaboard, where the wind had been S. and S. E. all day, at the approach of the storm, it backed round towards the E. and E.N.E.; and inland, where the wind had been N.W., it backed round towards the N. and N.E., on the approach of the storm." p. 150.

I cannot perceive any relation which the direction of the wind, *previous* to the arrival of the storm, can have upon the question at issue. Nor do I perceive that this vast generalization of the previous winds, westward of the main line of the storm, is supported by any evidence, except by the single statement of the direction of the wind at Annapolis, at 4 A. M.

Sixth position. "Wherever the wind set in from the N.E., it ought not to have changed at all, according to the centrifugal theory, whereas it did always change round by the N. to N.W. or W., or by the S. to S.W., as it should do by the centrifugal theory." p. 150.

One fact is truly stated in this position, viz. that this gale, wherever it "set in [or continued to blow] from the N.E.," "it did actually" "change round by the N. to N W. or W." But the alternative fact is not found, of a change [veering] from N.E. "by the S. to S.W., as it should [not] do by the centripetal theory." For this theory (supposing the course of the storm to be N E.) requires the wind to remain unchanged till the arrival of the central lull, after which the wind should come out, with even greater strength, from the opposite quarter; or, if the point of observation be just without the lull, the change should then be very rapid, as the lull passes, (see figures 1 and 2.) The averment, that "according to the centrifugal theory," meaning, as I suppose, the whirlwind theory, the N.E. wind "ought not to have changed at all," is not only unfounded, but appears as difficult to account for as any which is found in any of these positions; as will appear by the illustrations above referred to.

I object, however, to the term "centrifugal," as here used: for no one, I believe, except Mr. Espy, ever talks of the wind blowing *outwards* from the centre, towards the circumference of a storm. The idea of the wind's blowing directly inward, and thence upward, or downward, and thence outward in all directions, in violent storms, of either large or small extent, I consider as being fanciful, and wholly opposed to all correct observations, as well as to the laws of motion and equilibrium, which pertain to both the ocean and the atmosphere.

Seventh position. "According to the centrifugal [whirlwind] theory, the wind never could change round, on the extreme N.W. boundary, from N. N.E. to N.W., as it did, according to the centripetal theory." p. 150.

All the strength of this position lies in the assumption, here repeated, (see position first) that the points from which the gale was reported at N.

N.E., were "on the extrême N.W. boundary" of the storm, an assumption apparently as gratuitous and unfounded as could well be made. We have already noticed the general line on which the first violence of the gale was experienced from the N.E., and I can find its direction, at this period, mentioned as N.N.E. only as follows, viz. in one of the accounts from Norfolk, (p 154) one from Bombay Hook, (ibid.) and possibly by constructive inference, at Point Lookout, at the entrance of the Potomac, (p. 158) and one also at Philadelphia, (p. 157) But at *all* these places, we find that the same accounts, or others, state the gale to have been N.E., on which line of wind Mr. Espy locates the centre of the storm. The reader will therefore be surprised to find this line, where the wind veered to N., N. N.E., and N.N.W., assumed also as "the extreme N.W. boundary" of the storm, where "the wind never could change round from the N.N.E. to the N.W., as it did," according to *either* theory.

The mere absence of reports from more western localities, would afford no good ground for this position; for the gale raged with destructive fury on the line here mentioned, which could not therefore have been its extreme border. It is true, that we have found it stated in my reports, that there was no *hurricane* felt at Baltimore; but the direction of the wind having been from off the land at that place, as well as less violent, there was no injury received, nor any cause for reporting a remarkable storm. That the storm, however, was experienced at Baltimore, I have never doubted, for the contrary supposition would be of the most incredible kind. Besides, Baltimore is but little out from the line of New Castle, &c. through Chesapeake Bay to Point Lookout; and I find, also, the following accounts which have not improbably met the eye of Mr. Espy, as part of the first is comprised in his details of evidence at page 156.

Baltimore Sept. 6. "The steamboat Norfolk left here on Monday morning, at 9 o'clock and when she opened the bay, [only twelve miles from Baltimore, and early in the day,] felt the gale severely; but being before [it] proceeded without fear. Off Point Lookout [N. point of the entrance of the Potomac] fell in with ship Repeater, Maxwell, who had anchored before the gale. During the gale, parted her small anchor, and capsized, and was fast driving on shore, when it was thought adviseable to cut away her masts. The Norfolk fell in with her, and towed her to Norfolk."

Another account says, the schooner Alert, Beers, rode out the gale under St. Mary's, Md., i. e. in the Potomac.

I may add also, that Mr. Espy, in admitting that on the extreme N.W. boundary the wind did change from N.N E. to N.W., has effectually refuted his own theory, as applied to this storm. See figure 1.

Eighth position. "On the extreme S.E. boundary, it could not blow at all from S.E. according to the centrifugal [whirlwind] theory: but it did, according to the centripetal theory, blow in that direction in many places on that border." p. 150.

It is here correctly stated that this storm (if blowing in the form of a regular whirlwind at its extremities) "could not blow at all from S.E. on the extreme S.E. boundary of its path;" for a like reason, that according to Mr. E.'s hypothesis, it could not blow from N N.E. "on its extreme N.W. boundary;" but in here reiterating the assertion, (see first position) that "*it did*, according to the centripetal theory, blow in that direction in many places on that border, for six or eight hours during the whole strength of the gale," he appears to confute himself; for, 1st. The gale could not have exhibited this duration and "whole strength" upon its extreme border; for this would

be contrary to all our knowledge of this and other great storms; and 2d, we have already seen, that it was in places nearer to the centre of the storm where the gale set in at S.E., and where its duration was not only six or eight hours, but, with vessels drifting before the gale, was eight and ten hours; *the duration of the gale being found greater on the line where it set in from nearly S.E. than on any other portion of its track;* as it should be, according to the whirlwind theory. On no hypothesis, therefore, could these places where the storm set in from S.E. and exhibited such strength and duration, have been at its "extreme S.E. boundary." Other evidence deciding this point has already been considered: (see under first position.)

Ninth position. "On the extreme N.W. border, according to the centrifugal [whirlwind] theory, it could not blow the hardest from the N.W., nor on the extreme S.E. border could it blow the hardest from the S.E., as it did in exact conformity with the centripetal theory." p. 150.

We have been showing that on the "extreme borders" here mentioned, "it could not blow the hardest," on any theory. The error or fallacy of the position, lies in again assuming for the "extreme border," the interior of the storm's path. But, by what process, or evidence, Mr. E. discovers that on these extreme borders, "it did blow the hardest" from S.E. and N. W., and "in conformity with the centripetal theory," I am at a loss to discover. The evidence of the manner in which the gale *did* blow, as we have seen, affords no support to this conclusion. This new fact, that the wind blew "the hardest" at the very point from which it first commences to blow, appears to be a more extraordinary discovery than any yet made.

Tenth position. "At Cape May it changed round from N.E. by E., and at Cape Henlopen it changed round from N.E. by N., in conformity with the centripetal, and entirely contradictory to the centrifugal, [whirlwind] theory." p. 150.

There is much error in this. 1st, A change of wind "round from N.E. by N.," pronounced to be entirely contrary to the centrifugal [whirlwind] theory"! I forbear to comment on such a statement. But, 2d, can Mr. Espy inform us how this change from N.E. *both ways*, at or nearly on the same point or line of advance, can be in conformity with his centripetal theory? especially when we find from the reports that the central lull visited both places. We have seen, that on his hypothesis, the N.E. wind on the central line, supposing the storm moving N.E., should not veer at all, but, at the expiration of the central lull, should come out at S.W. nearly, and this last wind having all the progressive force and velocity of the storm to aid it, should here blow with far greater fury than the previous N.E. wind. We are told, elsewhere, however, that the centre of the gale passed between these two points. But the diameter of the lull was such as to give a duration of half an hour at one place, and fifteen minutes at the other, moving with the velocity of 30 miles an hour. The fact alleged, therefore, cannot be known, and is also improbable; for according to the charts and Coast Pilot, Cape May bears from Cape Henlopen N.E. by N., distant but 12¾ miles, and the course of the gale being here N.N.E. nearly, would give a distance, *in the line of advance* between the two places, of less than three miles, while the diameter of the lull would appear, by these accounts, to have been at least fifteen miles!

At Cape Henlopen, "the gale commenced at half past 11 A. M. from E. S.E., and shifted in 20 minutes to E.N.E., blew very hard for nearly an hour, [evidently much longer,] a calm of half an hour then succeeded, and

the wind then shifted to the W.N.W., and blew, if possible, with still greater violence." Now, where do we find the wind, which, it is alleged, "at Cape Henlopen," changed round from N.E. by N., in conformity [?] with the centripetal theory." To show the error of this, I also add the following fact in relation to the direction of the wind at this place, viz. the pilot boat Oscar, Davis, of Wilmington, was driven ashore during the gale, about one mile S. of Cape Henlopen lighthouse, and the crew lost.* How could a *pilot boat* be thus driven on shore by a "N.E. wind changing round by N."?—or even by an E.N.E. wind. Can Mr. Espy inform us?

The mean of the accounts from these two capes, as before suggested, is probably an approximation to the true state of facts; and that the gale was not N.E. at these places, seems also apparent from the report from Morris River in the lower part of Delaware Bay, (N. J., and not Del., as previously given,) which states the gale there was "from E.S.E." And at Dennis' Creek, in the same vicinity, according to the reports collected by Mr. E., "the wind came on to blow about 2h. from the *eastward*, and continued to increase till about 5 P. M., when the wind *changed to the westward*, still blowing very heavy," (p. 157.) I also find reported from Mount Holly, in the interior of New Jersey, between the Delaware and the sea coast, a "heavy rain, with violent *east wind.*" (N. Y. Gaz., Sept. 8.) These facts serve to show, most conclusively, that the line of N.E. wind was not over the Capes of Delaware, as claimed by Mr. Espy.

The errors here involved have also been shown in the refutations of the third, fourth, and seventh positions.

Eleventh position. "Both in Norfolk and New York, the wind set in from near the N.E., and at the termination blew from S.W., which is the experimentum crucis in favour of the centripetal theory, and utterly inconsistent with the other. [?] In like manner at Ocracoke, it set in at E.S.E., and terminated at S.S.W.; and out at sea, on the extreme eastern borders of the storm, the wind blew for eight or ten hours from S.E. and S. by E., with but little change, as it ought to do, if the wind does actually blow towards the centre of the storm." p. 150.

We shall find, that the setting in of the wind "from near N.E." at New York, does not very clearly appear; and it would seem to have been *after* the termination of the gale at the above places that the wind blew from the S.W. The important fact, that at these places the gale veered by the N., and blew its greatest strength before passing the N.W. point, is kept out of view, and appears fatal to the centripetal theory and its "experimentum crucis." The wind reported at Ocracoke "from E.S.E. hauling round to S.S.W.," accords with the regular whirlwind action of the storm, provided its centre passed inside of that anchorage, as it probably did, and from thence to sea across Currituck Sound, the line of progress here being N. or westward of that point; although it does not appear whether the phrase *hauling round* is used in its proper sense, or to express a more abrupt and general change of direction. We again find here, also, the singular assumption which has already been disposed of, and which, as now presented, amounts to this; that an undefined point of observation, which would appear to have been moving to the northward and westward before the gale and the Gulf Stream, so as to carry the gale for eight or ten hours with but little change, was actually "*in the extreme eastern border of the storm!*" Infer-

* N. Y. Gazette, Sept. 8.

ences drawn from such positions as these, would seem to require no further refutation.

Twelfth position. "At the time the wind changed round to S.S W. at Ocracoke, it was blowing at Norfolk a violent gale N.E., nearly towards Ocracoke. Now, as these places are 130 miles apart, and nearly on opposite sides of the storm at that moment, it is utterly impossible, according to the whirlwind theory, that the wind at Ocracoke should be blowing towards Norfolk, and, at the same time, the wind at Norfolk be blowing towards Ocracoke. And this fact is entirely consistent with the centripetal theory."

We have here, if I mistake not, a further specimen of the manner of confounding, or passing over, the essential distinctions of time, place, and direction, for which Mr. Espy's meteorological papers are so remarkable. The evidence laid before us is this: "At Ocracoke, at daylight, wind E.S.E., blowing a gale; *after* hauling round to S.S.W., ceased between 10 and 11 A. M., both at Ocracoke and Portsmouth." At Norfolk, after 10 A. M., the wind *commenced* blowing a gale from N.E.; from 11½ to 12½, it threatened a general demolition; about 12, the wind shifted to N.W., [one other account mentions the wind as changing from N.N.E. to N N.W.,] and *continued* its fury half an hour longer; and at 4 o'clock, *the storm was over*, and the wind changed to S.W." The italics here are mine.

Now, 1st, as to time: The storm, it appears, ceased at Ocracoke between 10 and 11, and of course it blew from S.S.W. *before* this period, if at all; while at Norfolk the gale *commenced* blowing at N.E. *after* 10 o'clock. So much for the winds of this hurricane blowing at these two places "at the same time." 2, As to place and direction: a N.E. wind moving in a direct course from Norfolk for the distance of 130 miles, as protracted on Blunt's Chart, *would reach a point* 120 *miles W.N.W. from Ocracoke bar or inlet;* and this is called "blowing at Norfolk nearly towards Ocracoke"! We thus see, that the assumptions which are here made, fail altogether; but it will also be perceived, that there was sufficient time and space for the wind of the N.E. storm at Norfolk to turn towards the left, around the rapidly advancing axis of the whirlwind storm, without sweeping so far south as Ocracoke.

(TO BE CONTINUED.)

Progress of Practical and Theoretical Mechanics and Chemistry.

ARTICLES FROM THE FRENCH JOURNALS. TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE, BY J. GRISCOM.

Salts Arising from Organic Bodies. *By* M. V. REGNAULT.

In an elaborate memoir entitled "New Researches on the Composition of Organic Alkalies," it is stated by the author, in his conclusion, that "the preceding analyses show very clearly that all salts formed from organic bases with oxacids, include one atom of water necessary to their composition, and of which they cannot be deprived without undergoing decomposition. These bases, therefore, present a complete analogy with ammonia in its mode of action with acids. They combine directly with the hydracids without decomposition, forming hydrochlorates, and not chlorides, like

the mineral oxybases; and with oxacids dissolved in water, the vegetable bases unite by fixing one atom of water which enters into their intimate composition. The partisans of the theory of ammonium must admit an analogous theory with respect to the vegetable alkalies. Under this point of view it would be very interesting to study the action which anhydrous oxacids exert upon dry bases. But difficulties would here be met with greater than in the case of ammonia, arising particularly from the unstable nature of these bases and the great complexity of their composition. I have, however, commenced some experiments with the view to ascertain what takes place when dry bases are saturated with sulphurous acid.

It is remarkable that the azotized basic substances, of so interesting a character, latterly brought into view by M. Leibig, include one atom of water in many of the salts which they form with oxacids. It is highly probable that their oxysalts have an analogous composition.

Finally, urea, which, from the totality of its properties, cannot be considered as any other than an organic base, makes no exception to this general mode of composition, as I have ascertained by the analysis of the oxalate and nitrate of urea which have hitherto been regarded as anhydrous.

Ann. de Chim. et de Phys. Juin, 1838.

New Dropping Tube, (Pissetta.) *By* A. Levol.

I use for washing filters, a very simple dropping tube, which appears to have some advantages over those commonly employed. It is composed of a straight tube drawn to a point at its upper end, the other passing through the cork of a vial containing water, in the ordinary way; but I add a bent syphon tube, one of whose branches reaches the bottom of the vial, the other being outside. It is evident, that when the vial or flask is inverted, the flow will be in proportion to the height of the column of water, and that it may be accelerated by blowing through the outward branch of the syphon. This little apparatus (which allows us the use of hot water) has been recommended in the School of Mines. Idem.

On a New Electric Condenser. *By* M. Peclet.

This new condenser is composed of three plates of glass, roughened by rubbing the surfaces carefully one upon another. They are entirely covered with gold leaf pasted on with alumine. One of these plates, A, is fixed to a common gold leaf electrometer, its upper surface being varnished. The second, B, is placed on the first; it is varnished on both sides; a small, gilt, unvarnished, copper stem is fixed horizontally at a point in the circumference; it carries in its centre, like the movable plate of common condensers a glass stem, which serves as a handle. Finally, on this last plate is a third plate, C, with a hole in its centre, through which passes the stem of the plate B. The plate C, is varnished on the under side only, and its central orifice is furnished with a glass tube which encloses the stem of the plate B, but of a less height.

This apparatus is used as follows: we touch the upper plate with the metal whose action upon gold we wish to determine, and put the plate B, in connexion with the ground:—this connexion is then broken, the plate C, is raised, and we touch the plate A. This manœuvre is repeated a certain number of times. Lastly, by means of the stem of plate B, we raise at

once the plates B, and C; when the gold leaves of the electrometer diverge to a distance dependent on the number of contacts.

The cage which incloses the gold leaves is formed of parallel glass plates, and is placed on a screw tripod, furnished, on one side, with a vertical plate, pierced with a small hole, and on the other with a portion of a divided vertical circle, whose centre is at the same height as the hole of the plate and the upper extremity of the gold leaves: in looking through the hole of the plate we observe the deviation.

To give an idea of the power of this apparatus, I will mention two series of experiments. By touching the upper plate with an iron wire after 1, 2, 3, 4, 5, and 10 contacts, the leaves separated 9½, 20, 25, 31, 41, and 88°. By touching the upper plate with a platina wire, a single contact produced but a feeble deviation, which increased to 15° after three contacts, and to 53° after 20. The experiments with platina were made by using a platina wire which had just been reddened in the flame of alcohol, after washing the hands in distilled water. I had previously assured myself, by a great number of successive contacts in which I touched the upper plate with a finger, that the plates did not contain any electricity.

The new fact of the development of electricity by the contact of gold and of platina, was also directly proved by means of a simple condenser of extreme sensibility obtained by giving to the coats of varnish a suitable thickness, and rendering their surfaces perfectly plane.

By means of the double and common condenser, I have ascertained that all the metals on which I have operated were positive with respect to gold, and that arranged in the order of their electromotive faculty, in this respect, were ranked as follows:

Zinc—lead—tin—bismuth—antimony—iron—copper—silver—platina.

The effects produced by bismuth, antimony, and iron, are with difficulty distinguishable.

It is evident, from the disposition of the apparatus, that the quantity of electricity set at liberty, which causes the divergence of the leaves, is proportionate to the number of contacts; now it results from numerous experiments, that as far as about 20° the deviation is proportionate to the number of contacts, hence to this extent the deviation is proportionate to the quantity of electricity. It would be easy to make a table which would give the quantity of electricity corresponding to the deviations which exceed 20°, since these quantities are proportionate to the number of contacts.

Simple condensers, or multipliers, cannot, however, serve to determine the relation of the effects produced by the contact of gold and of different metals, since their relations vary with the thickness of the coats of varnish, as I have satisfied myself by a comparison of experiments with different apparatus.

The instrument which I have the honour to present to the Academy, possessing a sensibility in some sort indefinite, presents to physics a new means of investigation, which I hope may contribute to throw light upon the singular phenomena produced by the contact of bodies. Idem. Aout, 1838.

On the Temperature of the Earth in Siberia.—Extract of a Letter from M. Erman *to* M. Arago.

I venture to flatter myself that you will take some interest in the passages of my journal which relate to the climatology of Northern Asia. I

resumed my researches at the town of Jakoutzk. The bottom of a hole, which M. Scherguin, a merchant of that place, had dug to the depth of 50 ft. English, (with the hope of reaching an unfrozen stratum, whence water might be obtained, maintained the temperature, during the whole of my trials of it, of—6° Reaumur (= + 18° 5′ Fahr.) The temperature of the surface could not have surpassed that degree; though the place of observation was in lat. 62° 1′ 29″. This result appeared to me very paradoxical, but I have since proved it by observations on the temperature of the air in the same town, during several consecutive years, with thermometers which I have carefully compared with my own. The following are some of the results:

Temperature of the air in the town of Jakoutzk, during the year 1827,* in degrees of Fahrenheit.

Mean Temp.	6 A. M.	2 P. M.	9 P. M.
January,	— 33°	— 31°	— 32°
February,	— 44½	— 36	— 42
March,	— 17	+ 1.6	— 8
April,	+ 8	+ 30½	+ 17
May,	+ 36	+ 47	+ 38
June,	+ 59	+ 68	+ 54
July,	+ 64	+ 80	+ 62
August,	+ 57	+ 73	+ 58
September,	+ 39	+ 50	+ 40½
October,	+ 11	+ 21	+ 13
November,	— 13	— 9	— 18
December,	— 43	— 40	— 42

You will conclude, from these observations, that the mean temperature at Jakoutzk perfectly agrees with that of the upper strata which I had observed at the depth of 50 feet. It necessarily follows, that by digging deeper they need not expect to come to unfrozen ground, until an increase of heat is obtained, arising from an approach towards the centre of the earth, and amounting to 6° of Reaumur, (=13° 5′ Fahr.) The experiments hitherto made in the wells of exploration in Europe, and those made by myself in the Oural Mines, make this increase equal to 1° Reaumur for 90 to 100 French feet. I should not expect, therefore, to find unfrozen ground at Jakoutzk under a depth of 500 to 600 feet. The observations which M. Scherguin has made since my departure from Jakoutzk, and when they had extended the digging to 400 feet English, perfectly confirms my previous remarks; for they have found that

At 77	feet English, temperature	— 5.5 R.	= 19.6 Fahr.
119	" "	— 4.0	= 23°
382	" "	— 0.5	= 31°

but these trials indicate that in this country an increase of 1° R. requires a depth of about 60 feet English, which is a more rapid increase than in lower latitudes.

This is to be attributed, I apprehend, to the higher conducting power of the strata of Northern Asia than of those which we inhabit. In fact, the

* This was a temperate winter, for in 1828, the cold of January was

	6h. A. M.	2 P. M.	9 P. M.
Jan. 1828	— 54 Fahr.	— 48	51

excessive variations of temperature observed at Jakoutzk and other places in Eastern Siberia, during the course of a solar year, induce us to admit that the surface of the earth is there endowed with a radiating and absorbing power much superior to that of Europe.* Idem. Sept. 1838.

Rapid Mode of Reproducing One's Thoughts.

Doctor Desrivieres points out the following process. Take a thin sheet of lead, or other ductile metal, place it on a smooth hard table, and write upon it with a fine style, with a smooth blunt point, so as to raise the letters in good relief on the under side. A paste of any kind, or plaster diluted with water, is then used to fill the hollows formed by the style. When the paste, or plaster, is hard, the plate is turned over on a hard plane surface, an inked roller is passed over the raised letters, moist paper is then laid on it, and in defect of a little press, it may be struck with a fine brush.

Rec. Soc. Polyt., July 1838.

The Artesian Well at the Abattoirs of Grenelle, Paris.

This well has now a depth of 418 metres, (= 1371 feet.) The sound, or borer, weighs 20 thousand; its height is treble that of the dome of the Invalides, and it requires two machines of immense power to put it in motion. The instrument is still in the chalk bed, the hardness of which is comparable to flint. M. Mulot, the director, states that the sound advances a foot per day. Idem

Examination of Sea Water Collected during the Voyage of the Bonite, with Apparatus Invented by M. Biot. By M. Darondeau.

Five specimens of sea water, obtained at different places and depths, were brought in bottles with ground stoppers. They were only two-thirds full, because the bottles were of a greater capacity than the receiver of the apparatus. Five other specimens, taken from the surface and enclosed in like manner, filled the whole capacity of the bottles. One of these was broken on its way from Brest to Paris.

All the water taken at the surface was perfectly limpid; but that which came from beyond a certain depth contained a whitish flocculent matter held in suspension.

The experiments were all made in the laboratory of the College of France, under the eye and direction of M. Fremy. The density of the water was determined by a specific gravity bottle, comparing the weight of the sea water with an equal volume of distilled water at ascertained temperatures. The quantity of gas held in solution was made known by boiling a flask entirely full of the water, and receiving the gas over mercury. The carbonic acid was determined by potash, and the oxygen by phosphorus.

To ascertain the quantity of saline matter, Gay Lussac's process was followed by evaporating to dryness a given weight of water in a mattress of known weight, inclined at an angle of 45° to prevent loss by projection. The residuum, heated to dull redness, gives the saline matter, minus the chlorohydric acid arising from the decomposition of chloride of magnesium by the heat; but this was accounted for by determining the magnesia in the

* Journ. Frank. Inst., vol. xxii., p.p. 118, 286.

residuum and replacing its oxygen by an equivalent of chlorine. The following are the results:

Time and Place of taking Water.	Latitude.	Longitude.	Depth.	Density at 8° & 10° Cent.	Saline Residue in 100 Wat.	Gas in 100 parts Water.*	Composition of 100 parts Gas.		
							Oxygen.	Azote.	Carbonic Acid.
30th August, 1836. Pacific Ocean,	11° 8′ N.	108° 30′ W.	Surface,	1.02594	3.429	2.09	6 16	83.33	10.51
			70 fath.	1.02702	3.328	2.23	10.09	71.05	8.06
19th March, 1837. Gulf of Bengal,	11 45 N.	87 18 E.	Surface,	1 02345	3.218	1.98	5 53	80.50	13.97
			200 fath.	1.02663	3.491	3.01	3.29	38. 5	58.15
10th May, 1837. Gulf of Bengal,	18 0 N.	85 32 E.	Surface,	1.02611	3.378	1.91	6.34	80.34	13.32
			300 fath.	1.02583	3.484	2.45	5.72	64.15	30.13
31st July, 1837. Indian Ocean,	24 5 S.	52 0 E.	Surface,	1.02577	3.669	1.85	9.84	77.70	124 6
			450 fath.	1.02739	3.518	2.75	9.85	53.23	34.92
24th August, 1837. S. Atlantic Ocean,	30 40 S.	11 47 E.	400 fath.	1.02708	3.575	2.04	4.17	67.01	28.82

* Temp. 0° Cent. Pressure 760mm.

The table shows that generally the density at the surface is less than at a certain depth; in one case only, the water, at 300 fathoms, in the Bay of Bengal, had less density than the surface water, the difference being $\frac{3}{10000}$.

Generally the saltness was greater below than at the surface; in one case, however, it was less. These results seem not to be inadmissible, for there is a great difference between the temperature of the water at the surface and that at 800 or 400 fathoms.

The table shows that the surface water contained, in all cases, less air than that at a certain depth, and that the difference may amount to $\frac{1}{100}$ part of the volume of water.

Deep water also contains more carbonic acid than that at the surface. Does this gas exist ready formed in the water, or did it arise from the decomposition of the flocculent matters found in all the bottles of water from a great depth? This could only be determined by analysis made on the spot. We shall be always led by the use of Biot's apparatus, to confirm, perhaps, one of these two facts, equally remarkable: 1st, That sea water, at a certain depth, holds in solution a greater quantity of carbonic acid than that at the surface; or 2d, That at this depth it includes transparent animalcules, or at least an organic transparent substance, not found at the surface, and which is decomposed by degrees, depriving the air, held in solution by the water, of oxygen to form carbonic acid.

In the latter case, the proportion of oxygen in the acid from deep water, must be more considerable than that at the surface, for its free oxygen, added to that of its carbonic acid, forms, with the azote, a more oxygenated air than that of the atmosphere; whilst, in the former case, the free oxygen, and that of the acid, forms, with the azote, an air differing very little in composition from atmospheric air.

In our experiment made on board the Bonite, water from 380 fathoms, contained 1.62 of gas to 100 of water; and in two other experiments, water from 300 fathoms contained 2.20 and 3.89 of air to 100 parts of water. The air was not analysed.

Ann. de Chim. et de Phys., Sept. 1838.

Improved Mode of Magnetizing.

Captain Scoresby, in a letter to M. Arago, informs the latter that he had constructed a magnetic bar composed of 196 plates of steel tempered to the greatest degree of hardness, and 15 inches long. It had six times more energy than the bars he had previously formed of steel tempered in the usual manner. With this compound bar he had magnetized, by influence, or induction, at the distance of 11 inches, a polished soft iron nail, weighing 500 grains, so that this nail in its turn supported another weighing 389 grains. This bar would support, through a slab of marble, 7-8ths of an inch thick, a nail weighing 194 grains.

To bring the magnetic agency to its highest degree of power, Captain Scoresby uses steel of the greatest possible hardness, which allows the force to accumulate almost indefinitely. The following rules are laid down by this very skilful magnetician in his letter to Arago:

1st. A single bar, or plate, is stronger, *in proportion*, than two bars together, of the same dimensions, temper, quality and mass.

2d. A combination of bars, or magnetic plates, is always more energetic than a simple bar of the same steel, temper, form, or mass.

3d. The absolute increase of magnetic power in compound needles, diminishes gradually in proportion to the number of bars.

4th. Continual additions to a powerful combination of plates, or bars, cease to be advantageous beyond a certain limit, on account of the impossibility of obtaining a numerous series of pieces perfectly identical. Weak plates (whether inferior in quality or temper) not only add nothing to the force, but sometimes, their polarity being reversed, they produce a real diminution of strength in the whole system.

5th. A certain deterioration takes place in the permanent individual strength of all the bars in the compound at each addition of strength which the whole system receives. This change varies with the temper of the bars.

6th. Another loss of *temporary* force takes place in powerful compounds, so that a plate which preserves some strength when withdrawn from the system, may be neuter, or even have its poles reversed, when it makes part of the combination.

7th. The excess of strength in a combined system is greater when the bars do not touch each other. This augmentation increases when the space between the plates is enlarged.

8th. A greater number of plates may be combined with advantage if kept separate, than when in contact. The weakest plates become, under this arrangement, the most active.

9th. A partial separation, in the middle of the plates for example, the extremities being in contact, has some advantages over a contact throughout. The value of this advantage has been determined by experience.

10th. For the most advantageous combination of the plates, it is necessary to temper, not simply the extremities, but the whole length of the bar.

11th. Very thin plates (like those 2 feet long, and .042 inches thick) are susceptible of the greatest development of force, even separately, when tempered throughout their whole length.

12th. Thicker plates, and of certain proportions, on the contrary, receive separately a higher power when tempered only at the extremities, and not in the middle.

13th. Plates tempered in the coarsest manner are those which lose the least proportion of their force by combination. Thus, though their magnetic capacity be less than that of plates less tempered, their absolute power in a numerous combination is greater.

14th. The permanence of the magnetic state in a compound system, if left without a conductor or armature, is at least as high as in simple bars. It is decidedly the greatest when the plates are not in contact. Idem.

On the Action of Alkaline Solutions on some Metals. By M. Vogel, *of Munich.*

M. Payen published some years ago, an interesting memoir in which he showed that alkaline fluids preserved iron and steel from rust. Water containing from $\frac{1}{300}$ to $\frac{1}{2000}$ of an alkali has this property, and carbonate of soda, borax, and lime water, preserve steel much in the same manner as the alkalies.

The author of the present memoir goes into a careful examination of this subject, and thus sums up the result of his investigations:

1. That iron and steel may be protected from rust by weak alkaline solutions.

2. That steel bars preserve their metallic lustre in them, even when in contact with each other.

3. That the absence of air is not the cause of the steel being preserved from oxidation.

4. That antimony and nickel do not lose their splendour in weak alkaline solutions.

5. That bismuth acquires in them a brass yellow colour, and afterwards turns purple.

6. That zinc and cadmium acquire in them a grayish yellow coat.

7 That lead and tin are attacked by these solutions; the lead is covered with a carbonate, and deutoxide of tin is formed.

8. That copper is attacked more rapidly in weak alkaline solutions than all the other metals. Its oxidation is also accelerated in concentrated solutions.

9. That brass becomes black, while an alloy of copper and nickel retains perfectly its metallic brightness.

10. That potash and soda dissolved in much water, appear to produce the oxidation of copper by a *catalytic** influence.

11. Finally, that copper may be bronzed by alkaline solutions.

Journ. de Pharmacie, Sept. 1838.

Boots and Shoes Sewed with Wire.

M. Sellier of Paris, has secured by a patent in France the right of using brass wire for attaching the upper leather to the welt of shoes and boots. He urges that this metallic thread allows neither moisture nor dust to enter the shoe, and furthermore that it does not rip. The sewing is performed with as much ease, as with a waxed thread, nor is the work more costly. A member of the committee has worn a pair of Sellier's boots 18 months, in which time two strong soles were worn out, without any giving way whatever of the wire sewing. They were free from dampness, and from dust in a time of drought. Bull. d'Encour. Sept. 1838.

Note on the Employment of the Method of James Marsh, *in a Case of Legal Medicine. By* F. Thinus, *Pharmacien at Fontainebleau.*

On the 26th of last May, M. Mollier and myself were requested to subject to chemical analysis, the stomach and part of the small intestine of Lady D****, who died suddenly. Public clamour accused her husband of having poisoned her.

We were not long in discovering the presence of arsenious acid in these vessels, and in the fluid which they contained; and after having obtained the arsenic in a metallic state by the ordinary processes, we wished to make use, also, of the method of Marsh† for the same purpose.

A portion of the fluid taken from the stomach was acidulated with sulphuric acid and a piece of zinc placed with it in a tubulated flask, to the tubulure of which was adapted a fine pointed tube. After a few moments, the gas was inflamed, when a piece of porcelain being held over it, a coating of metallic arsenic was obtained, but the fluid swelled, and rose in the tube so much, that it was impossible to continue the operation.

* Journ. Frank. Inst. vol. xx., p. 144.

† Idem, vol. xviii., p. 338.

We then had recourse to Marsh's apparatus, and as the scum prevented a continuous flow of the gas, we allowed it to accumulate in the short branch of the tube, and opened the cock only when the froth had disappeared. This was expedited by moving a piece of ignited coal round the tube, bent at right angles about three inches above the cock to which it was adapted. This tube was heated to redness in the middle of its horizontal part.* A quantity of arsenic, quite considerable, was here deposited; and the extremities of the tube being sealed by a lamp, the specimen was easily preserved. This last method of decomposing arsenical hydrogen is unquestionably the best, for no portion of the gas is lost, and by continuing the operation, we obtain within a short space almost the whole of the arsenic contained in the substance to be analysed; and if we are careful as soon as the operation is over, to close the end of the tube, the arsenic preserves indefinitely its metallic brilliancy when exposed to the air.

We were given also some fecal matters to examine, which we had only to boil for a few moments in distilled water, to obtain, by the above process, results which were very satisfactory.

I ought to mention, that we rigorously examined the purity of the sulphuric acid and the zinc employed in the investigation, and after each operation we changed the zinc, lest some arsenic might be deposited on it.

My only object in this note is to recommend the process of Marsh as the most eligible for its simplicity, ease, and the certainty of its results. Our application of it is the first, I believe, in so grave a case of medical jurisprudence.

D*** was found guilty of poisoning his wife, and condemned to death on the 23d of August last, by the court of session of Seine and Marne.

Journ. de Pharmacie, Oct. 1838.

New Cyanuret of Iron. *By* M. Pelouze.

This is obtained by passing an excess of chlorine through a solution of cyanoferride of potassium, allowing the liquid to repose, or, which is better, to heat it to ebullition. A light, green, insipid powder is deposited, mixed with oxide of iron and Prussian blue. Treated with eight or ten times its weight of boiling hydrochloric acid, which destroys the Prussian blue, and dissolves the oxide of iron,—washed and dried in a vacuum, it constitutes the new cyanuret. Idem. Nov. 1838.

Analysis of Several Bituminous Minerals. *By* M. P. Berthier.

As bituminous substances have of late years claimed an increased share of public attention, this celebrated analytical chemist has examined the constitution of a number of those which have gained the most notice on account of their practical applications.

Bitumen of Seyssel. There are at Seyssel, (in the department of L'Ain) three kinds of minerals,—1. The sandy mineral. 2. The very fusible calcareous mineral. 3. The calcareous mineral of difficult fusion.

The *first* of these melts in boiling water, and becomes detached from the stony matters to which it was adherent. It rises to the surface, or sticks

* Journ. Frank. Inst. vol. xviii., p. 338. † Id. vol. xxii., p. 333.

to the sides of the vessel in brown lumps, or forms a transparent coating of a brownish red colour. A rich specimen of it gave

Bituminous oil	.0.86	bitumen .106
Carbon	.0.20	
Quartzy grains	.690	
Calcareous grains	.204	
	1.000	

In the mass it is much less rich. When purified by hot water, this bitumen is called *la graisse*, grease.

The *second* variety is called at Seyssel *asphaltum*. It may be pulverized and sifted, but the powder spontaneously forms into balls. The specimen analysed contained .11 of bitumen, 5.89 of carbonate of lime, without clay, and quite pure.

The *mastic* of Seyssel is prepared by mixing nine parts of *asphaltum* with one of the pure *grease* extracted from the sand.

The *third* variety is a compact limestone, in extremely thin, parallel beds.

It consists of

Bituminous matter,	.100
Argil,	.020
Sulphate of lime,	.012
Carbonate of lime,	.868
	1.000

The bituminous mineral of *Belley* is very similar to the preceding. It is found in several communes in very considerable quantities, near the surface of the ground. It is of variable quality. A variable specimen yielded

Carb. of lime,	.824
Carb. of magnesia,	.020
Sulphate of lime	.013
Argil,	.023
Bitumen,	.120
	1.000

Bitumen of Bastennes. This bitumen flows out from several openings or springs, mixed with water. Analysis of the solid gave

Oily matter,	.200	bitumen
Carbon,	.037	
Fine quartzy sand, mixed with argil,	.763	
	1,000	

Bitumen of Cuba. This is transported to Europe under the name of *Mexican asphalt*, or *chapopote*. It is a solid bitumen, which exists in abundance near Havana. It may be used with great advantage in paving. It consists, like the greater number of natural bitumens, of at least two different substances, the one soluble and the other insoluble in ether and spirits of tur-

pentine. It is the relative proportion of these two substances which imparts to each bitumen its peculiar properties.

Bitumen of Monastier (Haute-Loire.) This does not soften in the least in boiling water, and hence cannot be extracted by simple means in the large way. It contains.

Bituminous oil,	.070	.105
Carbon,	.035	
Water,	.045	
Gas and vapours,	.040	
Quartz and Mica,	.600	
Ferruginous argil,	.210	
	1.000	

This bitumen of the Haute-Loire differs essentially from those of Seyssel and Bastennes by its infusibility in boiling water, and its fusibility in alcohol. Annales des Mines, tom 13, liv. iii.

On the Red Colour of Salt Marshes. *By* M. Payen.

When sea water is subjected to spontaneous evaporation, the commencement of the deposition of salt is known by the appearance of a light red scum. A reddish tint is observable also in the salt when collected in heaps, and it then emits an odour somewhat like violets. This colouring is occasioned by little crustaceous insects of the order of branchiopodes, and genus *Artemia.* These little animals, about a third of an inch long, have the form of a very thin cylindrical or vermicular tube, furnished with two little antennæ and two round and elevated black eyes, with a narrow mouth under the eyes. They have 22 swimming legs, which take up half their length. They move with prodigious rapidity, but perish when the solution acquires the density of 25°. Their bodies then become red, and float over the surface in the form of a scum. Idem.

Copper in Cuba. *By* P. Berthier.

A French merchant has just brought from Cuba specimens of a metallic substance which may be obtained, as it appears, in very great quantities. I have found it to consist of melted sulphuret of copper, absolutely pure. Though it contains neither gold nor silver, it would be an excellent object of commerce, because it would be extremely easy to extract from it the 80 per cent. of copper which it contains. Idem.

Analysis of two Micas, with Bases of Potash and Lithim. *By* V. Regnault.

These micas swell easily at a red heat, without any sensible loss of weight, and are then easily pulverized.

Lepidolite rose Mica. This mica is presented under the form of very small rose coloured spangles. It is found disseminated in a keolin used in the porcelain works of Vienna, in Austria. It is separated in the levigations which the clay undergoes.

Composition.

Silica,	52.40
Alumina,	26.80
Deutoxide of manganese,	1.50
Potash,	9.14
Lithim,	4.85
Fluor,	4.40
	99.09

Yellow Mica. In large leaflets of a fawn colour.

Composition.

Silica,	49.78
Alumine,	19.88
Peroxide of iron,	13.22
Potash,	8.79
Lithim,	4.15
Fluor,	4.24
	100.06

Abstracting the fluor, the formula of these two micas is therefore

$$(\dddot{Al}, \dddot{Fe})\,\dddot{Si} + (\dot{K}, \dot{L})\,\dddot{Si}.$$

The mode of analysis is given by the author.

Annales des Mines, tom. xiv. p. 151.

Means of Reducing the Price of Public Clocks. By W. Wagner, *of Paris.*

A report by M. Francœur, on behalf of the Committee on the Mechanic Arts of the Societé d'Éncouragement, attests that the committee is persuaded of the utility which the public will find in the fabrication of the new clocks of M. Wagner, rue du Cadran; that they perform with exactitude and safety, and that the execution is in all parts complete.

The reporter remarks that the expense of at least from 1000 to 1200 francs is an obstacle to many churches, manufactories, and large edifices in the procuring of a public clock, and suggests that the reduction of price by M. Wagner to 3 or 400 francs, wherever there is a clock on which the hours may be struck, may open the way for overcoming it. At Moret there is a manufactory of what are called *Jura clocks*, in which all the pieces of the mechanism are made in the large way, and all made to fit; wheels, weights, bells, dial plates, hands, hammers, &c. are made, set up, and delivered in the market for 40 francs, and the clock goes very well. This great establishment has changed the face of the surrounding country, increasing the population, the erection of new buildings, and the general prosperity. The Jura clocks are acknowledged to keep as good time as can be expected from works of this kind, especially when the escapement, as is done by Wagner, has been retouched.

This apparatus is transformed by Wagner into a public clock, which strikes the hours on any required bell, by a hammer proportioned to its size. This is done by adding to the Jura clock a mechanism which answers the desired purpose.

To comprehend the play of this mechanism, imagine an addition to the Jura clock, consisting of a heaving striking weight, hammer, and fly to moderate the descent of the weight, and a very simple mechanical connexion of these with the clock. A lever retains the heavy weight, which lever is held in its place by the wheel work of the common striking part of the clock. As soon as the hammer of the clock is set free to strike the hour, the lever which holds the heavy weight is freed, and by the descent of the latter the great hammer is set in motion, and which, as a consequence, will strike as many blows as the hammer of the clock. Thus as many strokes will be heard on the great bell as the clock itself strikes, which has no other action on the mechanism connected with the great bell than to give it leave to speak. The hour will thus be struck twice, which is not an advantage to be despised, since it costs nothing, and is often useful.

A large dial plate and hands must be added to the Jura clock, adapted to its height or distance to be seen. The great number of public clocks, constructed on this principle leaves no doubt of the utility of the invention.

Idem. Oct. 1838.

New Mode of Preparing Carburetted Hydrogen for the Purpose of Illumination. By M. SELLIGUE, *Engineer.*

This new invention has gained for M. Selligue the premium of 2000 francs proposed by the Societé d'Encouragement. It consists in obtaining pure hydrogen by decomposing water by means of incandescent charcoal, and then carburizing it by mixture during the simultaneous decomposition of another liquid substance rich in carbon and hydrogen. Among all known substances, that which appears to answer best is the oil of schist, (l'huile de schiste.)

The furnace is composed, 1st, of three vertical retorts, communicating with each other, so as to form, in a manner, only one. In a double furnace there will be six retorts. These are all open at both ends, but closed below by sliding stoppers, (*couvercles rodés*) so that simple contact and the least pressure is sufficient to shut them firmly. The top of each retort is closed by a head fixed by keyed gudgeons and iron cement. Each head bears itself a stopper, or cover, like those below.

The first retort into which steam is introduced through a tube, communicates below, by a tube twice bent, with the second, which connects at top with the third by a similar tube, and this third retort has, below, a vertical tube with branches, by which the gas is conducted to a refrigerator, and thence to the gasometer. This tube dips into a trough of water, to serve as a hydraulic closure. The third retort bears at top a funnel syphon, through which the carburizing substances are introduced. 2d. Two horizontal tubes, placed in the sides of the vault, serve as boilers to vapourize the water; each communicates at one end with the first retort by an arched tube, and to the other end is attached a funnel syphon, by which the boiler is supplied with water. 3d. Two furnaces. 4th. A chimney in four parts, uniting at first into two, and then into one, in order to regulate the fire with greater ease.

Operation.

Having filled with charcoal the first two retorts in each of the (double) furnaces, and suspended chains in the two last, in order to increase the surface, the fire is lighted, and when the retorts have attained a cherry red

heat, a gentle flow of water and oil is made through the syphons. The water falling into the boilers is instantly evaporated, passes into the first retort, then into the second, where it is deprived of its oxygen, and reaching the third, the hydrogen alone mingles with and carries along the carbonated hydrogen simultaneously formed from the oil in the last retorts. The united gases then issue from the lower end of the third retort, and press off through the branches, while the more volatile matters are deposited in the reservoir of water.

Idem.

New Steam-boat Enterprise.

A company has been formed for a steam-boat communication between Vienna and Smyrna, by the Danube, the Black Sea, and the Straits. Passengers whose business calls them into Austria, and who have no occasion to stop at Moldavia or Walachia, will not be subject to quarantine at Galatz, and only 5 days at Orsova. It was necessary, before this route was established, to submit to 24 days quarantine, i. e. 14 at Galatz, and 10 at Orsova.

Rec. Soc. Poly. Juil. 1833.

Elastic Boots with Movable Heels. By M. Quenet.

This invention has been patented. While the patentee preserves the entire elegance of the form of the boot, he has discovered the means of preventing the pain arising from the swelling of the foot. By a slight pressure on the bolt of a spring, the whole shoe may be lengthened about 12 lines. It is very convenient for those who in walking press harder on one side than the other. The mobility of the heel, and its peculiar structure, cause it to wear equally in all parts.

Idem.

Fonvielle's Filtering Apparatus.

A trial has been had in the Courts at Paris, relative to the validity of the claims of the "French Filtering Company," who are now the possessors of Fonvielle's patent, to an exclusive right, founded on the merits of this invention. It was urged by the opposing party, that this right, being dependent on the application of high pressure, is invalidated by the fact of a prior use of the same principle to the process of filtration, as was shown by brevets (patents) of an anterior date. This plea was answered on behalf of the Company, by the proof that Fonvielle's mode of applying high pressure was entirely different from those of his predecessors. These were to force the water through *tissues of felt, wool, or flax, or through skins*, while Fonvielle's consists in filtering *through sand, pounded stones, gravel, and other inert animal substances*, which is so different that previous to this date it had been found impracticable to apply high pressure to such filters, the effect being inevitably to overturn the filtering bed and confound the materials with the liquid to be filtered;—that this being the difficulty, in this consisted the merits of the invention. M. Fonvielle had discovered the means of so retaining and compressing the materials, as to be able to apply high pressure, the sole agent which can operate on great masses of water. In a word, filtration on a great scale is the principal object of Fonvielle's patent. It was shown that the greatest effect of preceding methods was to filter *five hectolitres* (=132 gallons) per day, whereas it was proved that

filters of the "French Company," of the same capacity, would give in the same time *fifteen hundred and two thousand gallons*, or even more. Hence the evidence of a new idea—a great and real invention.

But the patent of the Company proves its value by two other new and happy applications: the first is the facility of cleaning the filter, without unpacking it, by a simple play of opening stop cocks, continued for 5 or 6 minutes only. This alone is enough to condemn every other filter, *which cannot, like those of the Company, clean themselves.* The second is the happy use of the laws of hydraulic level, in raising the filtered water to a height nearly equal to that of the fountain head, a principle of the highest utility in the domestic, and other, arts, while all other filters leave the water simply at their feet.

The honourable testimony of the Academy of Sciences, evidenced by the report of Arago,* was brought into view, and the advocate for the Company, at the conclusion, read another communication, addressed to the President from the same academician, containing some new developments of the scientific question, and treating this delicate and interesting subject in the enlightened manner, and with the energetic precision, which distinguish his pen. We cannot withhold the following extract from it:—

"I will add a few words on the merits of the question. This will only be pursuing the task I have long imposed on myself, of defending the rights of inventors, dead or living, against imitators, copyists, and plagiaries,—a task in which, to the great displeasure of the English, I have been allowed to restore to our countryman, Papin, the honour of the discovery of the steam engine, and of steam boats.

"When the law declares *in general terms* (en thése générale) that a patent shall never be granted for a simple idea, it goes perhaps beyond its own object; but it thereby shows the complete separation which society ought to make between a theoretical and a practical machine. To transform an apparatus which works with difficulty, or scarcely works at all, into a powerful, common, economical machine, which, occasionally, changes completely the manufacturing aspect of a whole nation—nothing more is sometimes requisite than an apparently insignificant alteration, which, in the shops, might be designated by the simple term, 'a turn of the hand.'

"The machine which we owe to the genius of Watt, includes no principle which is not seen in the much older machine of Newcomin, only the steam was no longer condensed in the body of the pump, but in a separate cylinder. What did Bramah add to the principles of Stevin and Pascal in the hydraulic press? Nothing, absolutely nothing! He only modified the shape of the large piston, so as to render it completely tight and staunch. Watt and Bramah are none the less regarded as the principal and most skilful promoters of British industry. M. Fonvielle may have added to the results of his predecessors only his demonstration of the possibility of filtering under strong pressure through filters *par excellence*, composed of sand and pounded sandstone; he may have only proved that the two materials in question can be so disposed as to maintain their situation under the action of rapid currents, and not mingle with and be carried away with the fluid mass,—he is still an inventor: but he has done more; he has found the means of cleaning the filter without dismounting it, without handling it. The two inventions united form a process whose efficiency is not contested, and which provide the means of filtering vast masses of water with very

* Journ. Frank. Inst. vol. xxii., p. 206.

small machines. Nothing like this existed before. Never, for example, had the city of Paris suspected the possibility of filtering, on the spot, the water of the public fountains. Now, our citizens are certain of soon seeing this valuable improvement realized. The only water not subjected to filtration will be that for washing the streets. Well! this might have been possible without any one having recently invented any thing! The able engineers of Paris, the hydraulic engineers of London, where the subject of filtering was not long since an object of parliamentary investigation, might have had in their eye all the elements of a simple, elegant, economical solution of the problem, and yet no one has seized hold of it! Vain supposition! Such pretensions cannot be supported, without opposing the most useful thing in the world—common sense itself.

"The name of the engineer *Tom* of Greenock, has been cited in the memoir of our adversaries. This name, which was parenthetically introduced into my report, did not prevent the celebrated Milne, engineer of the New River, the chief hydraulic establishment in London, from considering Fonvielle's apparatus as a good and useful invention. When lately Mr. Milne came to Paris with Mr. Curtis, President of the Bank of England, for the purpose of inquiring relative to a project for the distribution of water at each house, and on which occasion the Municipal Council charged me with the preparation of the account of charges, Mr. Milne declared to me that he intended to apply to the '*French Company*,' *and purchase from them the right to their process of filtering.*"

Rec. Soc. Polytech., Juillet, 1838.

Progress of Civil Engineering.

Dr. Lardner's Instruments for Experimenting upon Railways and the Motion of Railway Carriages.

Instrument for Detecting Vertical Deflexion.—To test the formation and stability of the road, it was determined to observe the effects which the rails and their supports suffered by the action of the wheels in passing over them. Mr. Wood contrived and constructed instruments for this purpose, consisting of a simple lever, the shorter arm of which was placed either under the lip of the rail itself, or under a staple attached to the rail, so that when the rail would sink, the arm of the lever would be depressed, and if the rail would rise, the arm of the lever would rise also, by the superior weight of the longer arm. Thus every motion of the rail upwards and downwards would produce a contrary motion in the opposite end of the lever, and as the arms of this lever were unequal in the proportion of about six to one, the actual vertical deflexion of the rail was exhibited on a proportionally magnified scale by the motion of the longer arm. In order to register these deflexions, which usually were produced with great rapidity and in considerable number by the wheels of a train successively passing over the rail to which the instrument was attached, Mr. Wood adopted the same method as was previously used in several other self registering machines. A narrow strip of paper of considerable length, being rolled upon a small cylinder, was gradually unrolled from it to another cylinder, and as it passed from the one to the other, it was drawn over a disc, against which a pencil was pressed, which was carried by the longer end of the above-mentioned

ever. The motion of this pencil, upwards and downwards, produced by the deflexion of the rail, would, if the paper were quiescent, merely draw a vertical line upon it; but by the motion of the paper under the pencil, every separate motion of the pencil upwards and downwards, produced a waving line, the summit of each wave exhibiting the magnitude of each deflexion. Three of these instruments were constructed by Mr. Wood, with a view to expedite the taking of the observations, so that being applied to different parts of the rail, three sets of deflexions would at the same time be taken by one passage of a train.

Instruments for Measuring Lateral and Horizontal Deflexions.—It will be perceived that the effect of the last instrument was only to measure the deflexion of the rail downwards or upwards. After Dr. Lardner had been some time engaged in experimenting with these, he succeeded in constructing another set of instruments, capable of measuring similar effects in the lateral or horizontal direction. These instruments consisted of a compound lever by which any motion of the shorter arm was magnified fifty times, so that when the shorter arm was drawn back or drawn forward in the horizontal direction through the fiftieth part of an inch, the end of the longer arm was moved upwards or downwards, according to the direction of the motion of the shorter arm through the space of an inch. The shorter arm of this lever, bore by a hardened steel point upon a flat circular disc of steel constructed on the end of a short rod or cylinder, moving horizontally in guides. The other end of this cylinder was presented to the side of the rail to which was attached a hardened steel point which bore upon the disc; so that the cylinder thus moving in guides was placed between the two steel points, one attached to the rail, and the other to the short arm of the lever of the indicating instrument. The longer or indicating arm was furnished with a pencil, which registered its indications on paper, in the same manner as in the instruments contrived by Mr. Wood for registering the vertical deflexions. The two sets of instruments combined rendered the means of observation of the effects of carriages upon the rails complete. It is evident that the rail could not suffer any effect which would not be felt, measured, and registered by one or both of these instruments. To the experiments made with these instruments, at least one-third of the whole period of this inquiry was devoted, and many hundred diagrams were taken, exhibiting the effects produced not only on the rails themselves, but on the chairs by which they are supported on the timbers, where timbers are used, and on the stone blocks on which other railways are supported.

Instrument for Testing the Laying of Rails, &c.—In addition to these tests of the effects produced upon the rails by the traffic over them, Dr. Lardner proposed to apply another which would show the state of perfection with which the rails were laid, or their state after the lapse of any length of time. It is evident that on a straight line of railway, the two rails on which the wheels of the same carriage rest, ought to be at the same level, so that the carriage may stand in a truly horizontal position. A newly constructed road ought to be laid with sufficient precision to effect this; but after being worked for any length of time, it cannot be expected to preserve it. One rail will subside more than the other, owing to the different degree of firmness of its supports, and of the ballasting beneath them; in fact the rails will lose the correctness of their relative level, and the carriage, when resting on them, will not be as truly vertical in its position as it would be on a well and newly made railway. An instrument was contrived and constructed, which, being rolled slowly along the rails, wrote upon paper,

as it went, with considerable precision, the extent to which the rails of the same line departed from a common level. The operation of this instrument may be easily explained. An iron tube, of about an inch in diameter, is formed of a length equal to the gauge of the line, or the width of the rails; at each end of this are two shorter legs at right angles to it, open at their ends; thus when the intermediate tube is placed in the horizontal position, the two short legs may be brought to the vertical position; and if the horizontal tube be extended between the lines of rails, the vertical tubes will be immediately over the centre of each rail. Now let us suppose this instrument fixed to a vertical frame, and placed on wheels or rollers, which shall rest upon the rails; let mercury be introduced into it until the horizontal tube and about half of each of the vertical tubes are filled. If the rollers which support the instrument be now made to rest upon the rails, the short tubes being in an upright position, the two surfaces of the mercury in the short tubes must, by the laws of fluids, be at the same level. If the rails be not at the same level, then the mercury will stand higher in the tube which is over the lower rail, than in that which is over the higher one. If the instrument be reversed, the mercury will also reverse its position relatively to the instrument, and will still stand higher in the tube which is over the lower rail.

When the instrument is adjusted, which it may easily be by this process, so that when the rails are truly level, the height of the mercury in one of the tubes is accurately known, then every change which that column of mercury undergoes, while the instrument is rolled over the rails, will indicate a corresponding departure in the rails from the common level, that departure being twice as great as the rise or fall of the mercury.

In order to make this instrument register its own indications, Dr. Lardner placed on the column of mercury in the tube a float, the rod of which resting above the tube, moved in guides, so as to rise and fall regularly on the surface of the mercury on which it rested, rose, and fell; to this rod was attached a pencil, under which paper being moved in the usual way, a curve was described, whose height above a datum line was always equal to half the departure of the rails from a common level.

Among the several instruments, the invention and construction of which have arisen out of this important inquiry, there is not one which has equal general utility with this self-registering level, and it is only to be regretted that its construction was completed at so late a period that it has not been applied so extensively to the different lines as might have been wished. Its use, however, will not be confined to this investigation. The advantages which it will offer as a test of the condition of a newly made line, or of the manner in which the contractor will preserve one in operation, is obvious. It will be a check, whose indications cannot be disputed, and they are indications which involve the best qualities of a well made line. It is evident that its usefulness in practice may be extended by adding to it two other instruments on the same principle, to be rolled each along the same rail. The object of these would be to register every change of level of each rail, independently of the other, in addition to the register preserved by the present instrument of the departure of the two rails from a common level.

Instruments for Measuring the Vibration of Carriages.—An iron tube is extended across the floor of the carriage from door to door, from which rise two perpendicular legs at each door to the height of about twelve inches. The horizontal part of this tube extending along the floor is filled with mer-

cury, which likewise fills the legs to the height of some inches from the angle of the tube, being similar in all respects to the tube used in the instrument for recording the relative levels of the rails. The principal irregularity of motion to which railway carriages are liable, being a lateral swinging to the right and to the left between the rails, this motion immediately affects the horizontal column of mercury which fills the tube extending along the floor, and the inertia of this column causes the column in the vertical tubes to oscillate in proportion to the lateral vibration of the carriage. A float is placed on the mercury in one of the vertical tubes, which bears a pencil similar to that described in the self-registering level, which pencil inscribes on paper each particular oscillation of the mercury, and its exact extent.

This, however, is only one of several irregular motions to which the carriages are liable. Another of these is a rocking motion, arising partly from the former lateral vibration, and partly from the irregularity of the level of the rails, either side of the carriage alternately sinking and rising, either as the relative levels of the rails change, or as the conical tires of the wheels mount upon them and descend by the lateral vibration. This rocking motion would cause a body placed at either side of the carriage alternately to ascend and descend in the vertical direction through a corresponding space, and at similar intervals. This motion was measured in the apparatus in the following manner:—a syphon barometer, formed of an iron tube of nearly an inch in bore, was placed at the side of the carriage, near one of the doors. This barometer would be raised and lowered as the side of the carriage itself was elevated and depressed by the irregularity of the motion; and this alternate vertical motion being imparted to the mercury in the barometer, the latter, in virtue of its inertia, would receive a corresponding oscillation upon the same principle as the horizontal column in the tube was affected by the lateral motion. A float was placed in the shorter leg of the barometric syphon, which was made to inscribe the vibrations on paper in the same manner as the other instruments.

Besides this rocking motion, railway carriages, like others, are liable to more or less alternate vertical shake common to the whole body of the carriage; and although it was manifest that this was the smallest in amount of all the irregularities of motion, it was deemed right to ascertain it. This was accomplished by a small self-registering syphon barometer, placed in the centre of the carriage. All these three instruments were probably mounted upon the same frame, and their three pencils were made to act upon as many discs over which the paper was moved. The rolls of paper were all moved by the same winch, which acted upon a worm and a system of wheels driven by a common band, so that all the papers moved on the respective discs at the same rate, and received upon them the inscriptions corresponding to the different motions. In front of each disc was provided a stamp, bearing upon it the letter indicating the kind of motion recorded on the paper. Thus to the disc on which the horizontal motion was written, the stamp H was printed; to that on which the vertical motion was inscribed, the stamp V was printed; and that on which the rocking motion was recorded, was inscribed the stamp R. All these punches were attached to a common rod, and moved together by the lever provided for that purpose. A person stationed at the window of the carriage at the moment of passing each quarter of a mile, struck the lever with his hand, and punched a letter on the paper which moved over each disc. These letters divided the paper into spaces corresponding to each quarter of a mile, and vertical

lines were subsequently drawn from it, which resolved the diagrams thus formed into portions corresponding to each particular quarter of a mile of the road traversed.

In this manner the number of jolts of the carriage, and the nature and amount of each jolt which took place in each quarter of a mile, were registered.

So satisfactory have been the indications of this instrument, that by inspecting the diagrams the general state of the road can be with great certainty pronounced. In passing along a newly made line, for example, it is at once rendered manifest when the train passes from a cutting to an embankment, the latter being in a state of settlement, and therefore presenting more irregularity of surface.—*From Dr. Lardner's Article on the Great Western Railway Inquiry, in the Monthly Chronicle.* Lond. Mech. Mag.

Railway Improvement Society.

A private meeting, very numerously attended by deputations from most of the leading railway companies, was held on Saturday, March 9th, 1839, at the chambers of Messrs. Burk and Venables, in Parliament street, for the purpose of considering the propriety of forming a society for promoting and advancing the scientific improvement of railways throughout the kingdom, and for protecting, generally, the interests of railway proprietors.

Mr. George Carr Glyn, the chairman of the London and Birmingham, and North Midland Railway Companies, was called to the chair, and opened the proceedings, by adverting to the great and manifest importance of the proposed society, as affording a means of bringing the united experience and influence of the principal persons connected with railways, to bear upon all questions which may arise respecting them.

The honourable chairman further alluded to the very great ignorance which exists among many, even at this day, on the subject of railways, and the consequent prejudices which prevail against them, and pointed out the great advisability of having some regularly organized association, which would be looked up to as an authority on all subjects in which their interests were involved.

The meeting was subsequently addressed by several other gentlemen present, who all concurred in the importance of the proposed association, and dwelt on the advisability of forming, at its outset, a collection of maps, reports, models, and other scientific and statistical details relating to railways, which should be accessible to the several members of the society, and which would, in time, become a most valuable and interesting museum of reference on matters connected with railways.

Some discussion took place as to the amount of the subscriptions, and the name to be given to the proposed association, viz. whether it should be called the "Railway Society," or the "Railway Institute," but eventually this, with all other matters of detail, was left to a committee of management, formed of some of the directors of the principal railway companies present, who were empowered to add to their number if they should see fit.

Resolutions, embodying the substance of the foregoing remarks, were unanimously passed, and the several persons present having enrolled their names as the first members of the Society, the meeting separated. Ibid.

On Framing Lock Gates without Iron Work. *By* S. BALLARD, A. I. C. E.

The ledges, or horizontal pieces, are held to the back and mitre post by dovetail tenons and wedges, thus avoiding the use of iron T pieces and screw pins, which occasion the wood in immediate contact with them to decay, while the parts not pierced with iron are perfectly sound. This method was adopted in some gates on the Herefordshire and Gloucestershire Canal, and, after some years experience, is found completely successful. Tar and white lead are put into the mortises, and the wedge driven down upon it, so that every crevice is filled, and the joints rendered watertight; the planks also are fastened on with oak pins instead of nails.

Some discussion took place on the general opinion, that when dissimilar substances are in contact, as when a gate of one kind of wood is fastened with pins of another wood, some action tending to loosen the pins prematurely takes place betwixt them. Lond. Journ. Arts & Sci.

Tubing the Boilers of Locomotive Engines. *By* GEORGE BUCK, M. Inst. C.E.

In this communication the author has attempted to determine the diameter of the tubes of the boiler of a locomotive engine, so that the effect in the generation of steam may be a maximum. The following are the conditions upon which the problem is solved :—That the evaporating effect of the hot air, in passing through the tubes, is in proportion to the extent of surface in contact with the hot air, and as the time of contact, conjointly. The following are the results of the investigation:—The distance between the centres of two adjacent tubes should be equal to four times the interval between their internal surfaces; the diameter of each tube should be equal to 3 times the same interval; that the tubes should be as near each other as possible.

In illustration, Mr. Buck has drawn two sets of tubes of the locomotive boiler as generally employed, and one as they would be arranged according to the results of this investigation. On comparing the products of the aggregate periphery, and the aggregate area of the tubes, it appears that the boiler tubed according to the above theoretic proportion is from 23 to 26 per cent. superior to the others. Ibid.

Mechanics' Register.

Roberts' Self-Acting Mule.

The petition of Mr. Roberts, of the firm of Sharp, Roberts & Co. of Manchester, praying for a prolongation for seven years, of the several patents granted to him in the year 1825, for the United kingdom of Great Britain and Ireland, for that important invention, was heard lately before the judicial committee of her majesty's privy council:—present, the marquis of Landsdowne, lord president; lord Lyndhurst, lord Brougham, and Sir Herbert Jenner. Counsel for the petitioner, Sir Frederick Pollock, and Mr. Teed. No caveat having been entered to oppose the application, the Attorney General briefly addressed their lordships, stating that on the part of the crown, he had no objection to offer to the prayer of the petitioner being granted. A model of the machine was then exhibited, and the nature and objects of the invention were explained to their lordships. Evidence was

next given in support of the allegations contained in the petition; and after a short consultation, the marquis of Lansdowne, on behalf of the judicial committee, granted a prolongation of the several patents for the term prayed for, on account of the great ingenuity and merit of the invention, and the obstacles which had, from time to time, been opposed to prevent the patentee from deriving a fair compensation for so important an invention during the original term of the patents. Lond. Mech. Mag.

The Patent Safety Fuze.

Before the invention of the safety fuze, the loss of life in the Cornish mines was frightful. No one, unless entirely destitute of benevolence, could then take up a newspaper without having his soul harrowed with the heart-rending accounts of mutilations and loss of life, arising from premature explosions in blasting. Nearly every week the shocking details were before us. To one the light of heaven was no longer a blessing—another passed the remainder of his life a maimed man, while many left widows and children to helpless lamentation and starving want. The safety fuze was introduced—mine after mine adopted it—and, in proportion as the circle of its use became wider, the accidents within the circle became fewer. At the present time, being used in nearly all the mines in Cornwall, nearly all accidents from premature explosions have ceased. The fuze is about $\frac{3}{16}$ths of an inch in diameter, and has the appearance of varnished cord. Its advantages over every thing previously used are many, and striking. The time of the laborers is saved; no needle being used, no time is lost in priming, making touch-paper, &c. The fuze is placed in the charge, tamped up, and immediately fired. It burns so slowly (about eighteen inches a minute) as to afford ample time for the laborers to retire. It is certain—not one in a thousand fails—with care, not one in a million. Disregarding the saving in time, and the certainty—and this is immense—the whole expense of the fuze is saved in gunpowder alone. Owing to the size of the nail hole, in the common process, much of the powder escapes; the whole of this is saved, and it amounts as proved by experiment, to fully one-fifth of the gunpowder used. It is equally applicable to wet ground as to dry, for conveying fire 200 hundred feet under water, as through the air or beneath the earth. Combining then certainty, economy, and safety, the safety fuze is one of the most useful inventions of the nineteenth century.—*Sheffield Iris.* Lond. Mining Journ.

A Fact for Frame-work Knitters.

Under the head of "Hosiery," the Penny Cyclopædia contains the following observations, which are already, or will presently be, applicable to every branch of cotton manufacture:—"At this moment, (July, 1838,) stocking frames, with a rotary action, in which 12 fashioned stockings are made at the same time, superintended by only one man and a boy, and worked by steam power, have been successfully brought into operation at Nottingham, and bid fair to supersede the use of the reciprocating engine, in which but one stocking can be made at once by a single workman. The economy in the process of manufacture that will be thus effected, is very great, and may be the means of securing to our manufacturers for some time longer the supply of foreign countries—a branch of trade which was fast leaving us. The principal seat of the cotton hosiery manufacture abroad is at Chemnitz, in Saxony, where, owing to the low rate of wages, as compar-

ed with the earnings of the weavers of Nottingham, goods are made with yarns imported from Lancashire, at prices which have excluded English goods from third markets, and have even brought them into consumption in this country, after paying a duty of 20 per cent.!" Lond. Mech. Mag.

Amount of Silver Produced in Great Britain.

The total quantity of silver annually produced by the mines of Great Britain, is not, perhaps, very accurately known, being derived from fluctuating and scattered sources, but may, I believe, at the present time, be estimated at 10,000 pounds troy, and may therefore amount in value to nearly 30,000*l.* Notwithstanding the occasional production and richness of the actual ores of silver in some of our mines, it is certain that they do not at present contribute any very large proportion to this amount, of which the greater part is derived from argentiferous galena. The same remark, indeed, may be applied to the silver produced by the mines of Europe generally, in most of which argentiferous galena is the most productive ore.

From the present activity of the lead mines, the trials making in the Beeralston district, and other circumstances, combined with the very ingenious and economical mode of refining lead, which has been introduced within the last few years by Mr. Pattinson, of Alston, and by which a much smaller produce of silver may be profitably extracted than was formerly the case, it does not appear improbable that the amount of silver may be in time somewhat increased, although it is never likely to form a very important feature in the mineral produce of this country. Lond. Min. Rev.

Statue to Geo. Stephenson.

We observe, with pleasure, that a well-deserved tribute of admiration and respect is about to be paid to an individual, to whose genius and untiring energy his country is deeply indebted for one of her grandest modern improvements—the formation of railways, and the application of locomotive power—we allude, of course, to George Stephenson, Esq. A committee has been formed, embracing many of the first names connected with the iron trade, to consider the subject of a "Stephenson Memorial;" and we hear that a colossal statue is spoken of, to be erected in such part of the kingdom as may hereafter be determined upon, and formed of that most appropriate material—cast-iron. Lond. Min. Journ.

Glass Cloth.

We have been favoured with an inspection of a new and curious fabric, manufactured by Mr. Richard Baker, of Ossett, near Dewsbury; it is a web of glass cloth, which has a very splendid appearance. The ingenious manufacturer has so far succeeded in annealing this very brittle substance, as to admit of its being wove like cloth. It is deposited for inspection in the North of England Society of Arts, together with a slipper of the same material.

Ibid.

LUNAR OCCULTATIONS FOR PHILADELPHIA, JULY, 1839.					Angles reckoned to the right or westward round the circle, as seen in an inverting telescope. ☞ For direct vision add 180° ☜	
Day.	H'r.	Min.	Star's name.	Mag.	from Moon's North point.	from Moon's Vertex.
1	13	33	Im. φ Aquarii	,5,	142°	104°
1	14	43	Em.		290	264
6	15	30	Im. b Pleiadum	4,5	135	80
6	16	23	Em.		274	217
6	16	14	Im. c "	5	176	120
6	16	43	Em.		234	178
6	16	0	Im. d "	5	69	18
6	16	43	Em.		341	285
6	16	30	Im. η "	3	80	25
6	17	21	Em.		330	274
8	15	47	Im c Tauri	4.5	44	355
8	16	17	Em.		335	285
14	8	3	Im c Leonis	5.6	88	138
14	8	55	Em.		207	258
26	8	50	Im χ^3 Capricorni	6	80	39
26	9	54	Em.		320	285
28	15	24	N. App. ☽ and 81 Aquarii 6 ☽ So. 0′4			

Meteorological Observations for January, 1839.

Moon.	Days	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inch's	Inch's			Inches.	
	1	10	23	30.76	30.70	W.N.E.	Moderate.		Clear—do.
	2	24	37	50	30	E.	do.		Cloudy—do.
	3	33	39	30	24	E.	do.		Cloudy—do.
	4	33	38	10	12	N.	do.		Cloudy—do.
	5	34	38	25	25	N.W.	do.		Cloudy—do.
	6	3	33	35	35	N.E.	do.		Clear—do.
☽	7	29	37	10	29.90	S.E.	do.		Cloudy—do.
	8	40	41	29.65	86	W.	Brisk.		Clear—do.
	9	23	36	30.[illegible]5	30.25	N.W S.E.	Moderate.	.01	Clear—cloudy—snow.
	10	32	40	0[illegible]	29 96	S.W.	do.		Clear—do.
	11	40	53	00	30.00	S.W.W	do.		Clear—do.
	12	43	62	29.86	29 85	S W.	do.		Clear—do.
	13	32	38	30.20	30.20	W.	do.		Clear—do.
	14	32	39	29.9[illegible]	29.95	S.W.N.E.	do.		Cloudy—do.
⊗	15	20	24	90	90	N E.	Brisk.	,62	Snow—do.
	16	12	24	30.00	30.00	W.	Moderate.		Clear—do.
	17	14	32	05	10	W	do.		Clear—lightly cloudy.
	18	19	36	10	05	W.	do.		Clear—do.
	19	29	41	29.84	29.90	W.S.W.	Calm.		Flying clouds—clear.
	20	8	24	95	30.00	W.	Moderate.		Clear—do.
	2	24	34	75	29.75	S.W.W.	do.		Cloudy—do.
☾	22	0	29	60	60	S.W.	Brisk.		Clear—cloudy.
	23	20	12	40	30.15	W.	Blustering.	.02	Snow squall—clear.
	24	3	19	30.15	15	W.	Moderate.		Clear—do.
	25	16	39	15	05	S E E.	do.		Cloudy—do.
	26	46	42	29.40	28.80	S E.	Brisk.	3.68	Rain—do.—great freshet.
	27	24	27	30	29.33	W.	do.		Cloudy—lightly do.
	28	14	26	50	5[illegible]	W.	do.		Cloudy—do.
☺	29	21	31	56	60	W.	Moderate.		Clear—do.
	30	29	40	63	70	S.W.	do.		Cloudy—do.
	31	28	35	30.00	30 05	W.	do.		Clear—cloudy.
	Mean	24.83	34.16	29 95	29.95			4.33	

	Thermometer.	Barometer.
Maximum height during the month.	62. on 12th.	30.76 on 1st.
Minimum " " "	3. 24th.	28.80 26th.
Mean	29.50	29.953

JOURNAL

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MECHANICS' REGISTER.

JUNE, 1839.

Practical and Theoretical Mechanics and Chemistry.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

An Analysis of a Specimen of the Iron Ore from the celebrated "Iron Mountain," Missouri. By Robert E. Rogers, M. D., and Martin H. Boyé.

The celebrity which this iron ore has acquired from its reputed abundance and superior qualities, giving rise to extensive speculations, may render the following brief examination of it not without interest. The specimen furnished us was regarded as one representing the better quality of ore from this region.

Colour; steel gray, metallic lustre; compact crystalline texture; powder, purpleish brown; interspersed sparsely with white particles of quartzose gangue, scratches glass with facility, and is of very difficult fracture. It acts strongly upon the magnet, and exhibits polarity. Specific gravity, 4.78.

As the method adopted in the quantitative analysis of this ore is applicable generally to those iron ores containing, like this, only the oxides of iron, alumina and silica, as fixed substances, we give the details.

1.561 grammes of the finely pulverized ore was digested with muriatic acid until complete decomposition was effected, leaving the insoluble matter of a white, or light yellowish, colour; nitric acid was added, and the whole evaporated to perfect dryness; treated again with muriatic acid, then diluted and filtered. The insoluble matter thus obtained was dried at the temperature of 212°, which, after subtracting the weight of the filter, yielded 0.1.76, or 11.26 per cent. This was carefully washed from the filter, and boiled with a solution of carbonate of potassa, which dissolved the silica which had been chemically combined with the iron, leaving the gangue which had been mechanically admixed in the ore. The solution of carbon-

ate of potassa was over saturated with muriatic acid, and evaporated to dryness, and the silica thus rendered insoluble was filtered, washed, and ignited, and yielded 0.016, or 1.02 per cent., which, subtracted from the above amount, leaves 10.24 per cent. for the gangue, which, under the blow pipe, proved to be quartzose.

The muriatic solution containing the iron was treated with caustic potassa in excess, to precipitate the iron, heated to ebullition and quickly filtered. Muriatic acid was now added in excess to the alkaline solution, and subsequently neutralized with carb. ammonia, to determine the presence and amount of alumina, which separated in only a few floculi. The peroxide of iron which had been precipitated by the potassa, was next dissolved by muriatic acid, and again thrown down by ammonia, carefully washed, ignited and weighed, yielding as peroxide of iron, 1.409, or 90.26 per cent

By recapitulation, then, we have in the analysis for the 100 of the ore,—

Quartzose Gangue,	10.24
Silica,	1.02
Alumina,	a trace
Perox. iron,	90.26
	101.52

The excess is owing to a portion of the iron being in the state of *protoxide* in the ore. Calculated from this excess, the amount of protoxide would be 13.35 per cent., which requires precisely 1.52 of oxygen for its conversion into peroxide. 1.16 of the protoxide must be supposed to be combined with the silica, to form the subsesquisilicate of iron, the most common silicate in nature. The remaining 12.19, to be associated with the peroxide to form the magnetic oxide, would require of this latter 27.16. The constituents thus arranged will stand in the following proportions,—

Peroxide of iron, (Specular Iron)	48.23
Magnetic oxide,	39.35
Silicate of iron,	2.18
Alumina	a trace
Gangue,	10.24
	100.00

Accordingly, then, the ore, as a mineral, proves to be chiefly a mixture of Specular Iron and Magnetic Iron Ore.

The per centage of metallic iron in this ore is 62.58, while it may be well to remark, that the richest iron ore occurring in nature, the Magnetic, contains in its perfect purity, 71.8 per cent. The per centage in pure Specular Iron is 69.3.

Physical Science.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Remarks on Mr. Espy's Theory of Centripetal Storms, including a Refutation of his Positions relative to the Storm of September 3rd, 1821*: with some Notice of the Fallacies which appear in his Examinations of other Storms. By* W. C. Redfield.

(Concluded from p. 336.)

Having now done with Mr. Espy's array of numerical positions, we are next told that "the wind also changed round at Norfolk S.W. some time before it set in at New York. Also, two ships at sea, opposite the Jersey coast, had the wind blowing a gale from E.S.E. to S.S.E. At the same time, the wind was violent at Philadelphia and Reedy Island, [head of Delaware Bay] from N.N.E. to N.W. Now these places were nearly in opposite sides of the storm; the wind was therefore centripetal, as it blew from each towards the other." p. 150.

This is another example of the confusion of data above mentioned. The "*same time*" meaning only those long continued and undistinguishable portions of time, in which two ships "had the wind blowing a gale from E.S.E. to S.S.E., and at Philadelphia and Reedy Island, the whole time in which the gale was blowing and veering "from N.N.E. to N.W."! But if "these places were in nearly opposite sides of the storm," and "it blew from each towards the other," then we may suppose it to have blown from New York to Philadelphia, thence to Reedy Island, from this to the ships off the Jersey coast, and from the ships towards New York; while the natural current of S.W. wind at Norfolk was following after the storm. I might make a further analysis of this passage, but think it unnecessary.

The setting in of the N.E. wind at New York, requires, however, a distinct consideration. I had comprised the various reports from this city in my general statement, "from N.E. to E." One or two accounts say N.E., as does the report from Jersey City; while at the Quarantine at Staten Island, five miles below, where the direction would be most likely to be known, it is stated at E.S.E. or E. A majority of the city accounts which I have seen, also fix the onset of the gale from E. or E.N.E. It is only by a comparison of such reports that we can arrive at a reasonable conclusion, and the mean of all the accounts published at that day would be E. by N., probably near the truth. Mr. E. himself gives an account stating it at "E. S.E., veering to E. and E.N.E.," and another which fixes it at E. (p. 157;) and he can hardly be justified, therefore, in assuming it at N.E. But we have other facts which remove all doubt on this point. Of the ships at or near the quarantine, one* or more was driven up the kilns, between Staten Island and Bergen Point. Also, the Hoboken ferry boat, which, after repeated trials, nearly reached the city, was blown off and reached the shore near Col. Stevens' (Hoboken.) (N. Y. Gaz. Sept. 7.) These facts cannot be reconciled with a N.E. wind. I may add here, that it is not uncommon to find errors of this kind made at New York; occasioned, perhaps, by re-

* Ship Chase.

ferring the N. point to the course of the North River, or to Broadway, which are about N.N.E. and N.E. by N., respectively.

We are next told, that "while the storm was passing over Connecticut, the wind blew *constantly* in the S.E. corner from the S.E., while *at the same time*, in the N.W. corner of the state, the wind was blowing a furious gale from the N.W., and Mr. Redfield himself testifies, that the 'trees and corn in this corner of the state were uniformly prostrated towards the S.E., while even as far inland as Middletown, they were uniformly prostrated towards the N.W.'" p. 150, 151. The italics are mine:

We have here a further combination of errors, of a like character with the preceding. 1. In assuming that the wind blew "constantly" from the S.E. in the S.E. corner of Connecticut; for the gale here set in at S.E. or S.S.E., and veered round by S. as it passed over; a fact well known to me from the beginning, but not noticed in the newspaper accounts of the storm. 2. The "furious gale from the N.W." "in the N.W. corner of the state," was not as strong as the earlier S.E. gale in the central part of the state, and did not blow "at the same time" that the gale was south-easterly about New London; but at a later period, when the central portion of the storm had advanced into Massachusetts, and the gale had ended on the southern shores of Connecticut. 3. It was a north-easterly wind which prevailed in the N.W. corner of this state, "at the same time" with the south-easterly wind on its S.E. border; and being a retrograde wind, minus the progressive velocity of the storm, as well as exterior to its severest action, it caused little prostration; this effect being chiefly produced by the closing wind from the N.W. quarter, on the cornfields, after the S.E. portion of the storm had passed from Connecticut.

On these points I feel it to be right to speak with that confidence which a knowledge of the facts inspires: having spent several days in Berkshire county, Mass., immediately after the storm, and having also traversed its field of action, on different routes, for more than 60 miles, on a course transverse to its line of progress, and for 40 miles in the opposite direction, at the time when the facts of the case and the effects of the storm were fresh in existence, and in the minds of every observer. My original account in the American Journal of Science, from which it is now attempted to force a conclusion in favour of the centripetal theory, was couched in very general terms, having reference not so much to distinctions of time and exact direction, as to other considerations of a more general character; and the use of the qualified phrase, "*about* the same *period*," was then thought sufficient to prevent such a misconstruction as is now attempted, in support of a newly conceived theory.

We find in the two succeeding paragraphs, (p. 151,) that Mr. Espy has fallen into a similar error, by assuming, once more, that the S.E. and N.W. winds noticed in Connecticut, and also a S.W. wind which one account states to have followed or closed the storm at New York, were simultaneous parts of the gale, blowing in a rectilinear direction towards a point westerly of Middletown. The error, I believe, has been sufficiently exposed. In the next paragraph, he says: "We have no account how the wind blew to the N.E. of the point in Connecticut, towards which these currents blew, but as the wind set in from the N.E. in front of the storm, wherever we have any account, [?] it is highly probable that here too the wind was blowing from the N.E. at the same time." p. 151.

The last fact assumed here, is perhaps one of the grossest errors that I have been called to notice; as will be obvious I think to every one who ex-

amines the various accounts of this storm. Its commencement from the S.E. quarter at Hartford, Springfield, and Worcester, as well as other places "in front of the storm," I should think could hardly have escaped his research: but lest he should attempt to reject these, I quote the following, from a locality which appears to be N.E. of the point above alluded to.

Northampton, Mass., Sept. 5. A heavy storm of wind and rain from the S. and S. E., passed over this town on Monday evening last. One of the court house chimneys was blown down, and a barn belonging to Mr. Enos Cook. Considerable injury was done to orchards; trees were uprooted or shattered to pieces. Cornfields are prostrated.—*From N. Y. Gaz., Sept.* 13.

The S. wind first mentioned here, I presume to have been the fresh southerly wind which immediately preceded the gale, and which passed over Connecticut, heavily charged with condensed vapour, or sea scud, such as not unusually produces rain higher up the country. The direction of the gale here, as well as throughout this region, appears destructive to the above centripetal hypothesis.

We have seen from the foregoing, that this storm did not "blow inwards" from "its borders towards its central parts," as Mr. Espy next alleges; but circuitously, in the manner of a great moving whirlwind, and revolving constantly around its progressive axis in the direction from right to left, or contrary to the hands of a watch which lies with its face upward.

We next find, that on closing up his allegations Mr. Espy does "not say that the wind blew to one central point from every part of the circumference;" he says "this is hardly to be expected, even if the storm was perfectly circular, for reasons too obvious to require explanation." p. 151. I agree most entirely in this conclusion: but which was probably intended only as a qualified indulgence to his theory—an indulgence which he no where allows to the whirlwind storm. The probable origin of this concession I may have occasion to notice.

Mr. Espy next considers it "almost certain that the diameter of the storm was longer from S.W. to N.E. than from S.E. to N.W.," and estimates the former at "more than 300 miles;" and that the diameter from S.E. to N.W., when the storm reached Connecticut, certainly was not more than about 100 miles—for at Providence it was not of a violent character, and about 50 miles N.W. of that city, the centre of the storm passed, so that here its semi-diameter was only about 50 miles." p. 151.

We have already seen evidence of the incorrectness of this conclusion; and it is not long since Mr. Espy pronounced a storm which was more irregular in its development, as being "so nearly round that it would be an affectation of accuracy" to consider it otherwise.* We have also found a S. E. wind reported at Northampton, which place, "as the crow flies," is more than 70 miles from Providence; not having yet reached the line of N.E. wind which he assumes for the centre of the storm. This inquiry is not for the violent portion of the storm, but for its extreme width; and we have already found its extreme border to have been far eastward of Providence, at which place its violence was sufficient to prostrate trees and buildings, a rope walk among the number. On the other hand, I find it stated that the steamboat Chancellor Livingston was detained no less than

* Journ. Frank. Inst., Oct. 1838, p. 225.

four hours by the gale at Poughkeepsie, which is 80 miles up the Hudson. We have thus a great addition to Mr. Espy's dimensions in this direction; and if we estimate its extent N.E. and S.W. by its duration at Norfolk, Capes of Delaware, and New York, where he claims *the centre* of the storm to have passed, it will afford little evidence of the elongation in figure which he has attempted to show.

We next find Mr. Espy resuming his aerial speculations; with which I have no wish to interfere. The averment that the "hypothesis of a whirlwind" does not explain the cause of the rain and hail, is both unphilosophical and foreign to the issue of fact in which he has joined. The attempt to find a universal solution of nearly all atmospheric phenomena, in the theory of aqueous condensation, in the present state of our knowledge, appears like "advancing backward" towards the dark ages of meteorology and other sciences:

The attempt which is next made to press Dr. Mitchell's prognostics, quoted by me, into the service of the centripetal theory, is an example of the facility with which Mr. E. causes nearly all atmospheric phenomena to perform the same service.

"When a haze or cirrus is seen [from New York] over Staten Island at S.W. or more southerly, [say S.S.W. and S.] the storm of the succeeding day will blow from the *north-east,* but if it appears over the Jersey shore of the Hudson from W.S.W. to N.W., then the storm is expected to blow from the S.E. From this it would appear that the wind blows towards the cloud of an approaching storm." p. 153.

Thus, if I understand Mr. Espy, when the cloud first seen southward of New York has moved 12 or 18 hours in a N.E. direction, so as to be found over Massachusetts Bay, or farther distant, and the great body of the storm is spread over the ocean, nearly opposite New York, *then* "it would appear" that the N.E. wind at the latter place "blows towards the cloud of an approaching storm." (!)

The observation ascribed to Dr. Thomas, of North Carolina, on the longitudinal extent and appearance of certain thunderstorms, as they appear in the western horizon, and their smaller extent from S.E. to N.W. is such as must have been often made by every observer. These appear to form on a line of disturbance or disruption, where a portion of the lower wind becomes connected with, or is broken by, a colder, or higher, stratum. But I am at a loss to determine what analogy or connexion these appearances can have with the storm of 1821, or with others of a like character. This attempt at analogy appears as remarkable as the avowal which precedes it, (p. 153, line 8, 10,) that all "phenomena connected with storms" "are explained by the evolution of caloric in condensation of vapour," an avowal well suited to the ultraism of Mr. Espy's calorific theory.

Mr. Espy having closed his "investigation" of my storm of 1821, in his capacity of meteorologist of the joint committee, and after claiming both fairness and demonstration as pertaining to his deductions above noticed, adds the following, which perhaps is intended as an additional "demonstration."

"Moreover, as the wind on the S.E. side of the storm had been blowing all day, before the storm came on, from the S.E., and on the N.W. side of the storm from the N.W., there appears no reason for the motion of the storm from the S.W., but the uppermost current of the atmosphere, which is known to be always moving in this direction." p. 158.

So far as I know, we have never learned that "the uppermost current of

the atmosphere" is always moving from S.W.; or that any observations have ever been made upon its movements. We know from ocular demonstration, as well as from other indications, that *several* horizontal currents are usually, if not always, manifested in the atmosphere, pursuing their several courses, sometimes over vast surfaces, one above another; but it is only the lower and denser of these currents of which we can often take cognizance. But, if by "the uppermost current," be only meant those currents which usually prevail in the common region of the clouds, then the *known direction* here asserted, requires much qualification. For, having made more numerous and longer continued observations upon this subject, recorded daily, than have yet come to my knowledge from other sources, I am able to say that these *currents* usually prevail, in this region, between S. W. and N.W.; and in the greatest proportion from about W.S.W.

Nor do I perceive what influence an "uppermost current" could have in driving forward this storm. The "evolution of caloric in the condensation of vapour," both before and during the storm, having apparently been confined to the lower atmosphere or wind, the course of the storm, upon this theory, I should think, ought to have been with the south-easterly wind which is so generally reported previous to the access of the gale, and which appears to have prevailed beyond its borders. Besides, an upper current in the region spoken of, as may be often seen, and is recognized by Mr. Espy, appears to produce no appreciable effect upon the course or velocity of the wind, or stratum of atmosphere moving below it. I can see no reason, therefore, why the "uppermost current" should govern the course of the storm; unless, indeed, it were to encounter the vast ideal spire, or ascending column, which Mr. Espy erects in the centre of his centripetal storm. But of this we can perceive no evidence in the undisturbed movement of the higher stratum, which is often witnessed for days before and also immediately previous to the arrival or passage of the centre of the gale; the placidity of which higher current appears to remain undisturbed. Moreover, according to analogous statements of Mr. E., the top of this spire should perhaps be considered as being "blown off," or else spreading out, like a great mushroom, in space which was already occupied by these higher currents!

In my first paper, I attempted to indicate, in a general manner, the causes which must govern the course of our great storms, as being found in the *general course of the great inferior currents of wind*, of which I considered the trade winds as forming an integral portion.* The general course of the aerial currents at the common height of the clouds, is here deemed important, only so far as it may indicate the *generally uniform course of the inferior atmosphere*, separated as these higher currents are, from obstructions and deflexions, the eddyings or gyrations, as well as retardations, which pertain to the surface winds which lie at the very bottom of the aerial ocean. But it appears from my long course of observations, as well as from facts stated elsewhere, that an upper current of wind can have but litte influence upon the course, or blowing direction, of the mass or stratum of wind lying beneath it, as before noticed.

I may here notice, that in his "Examination," &c. in the Jan. No. of this Journal, Mr. Espy speaks of the known S.E. direction of the upper wind, flying above the trade winds in the West Indies, (p. 49) but what is the extent or foundation of this knowledge does not clearly appear. Is it

* Silliman's Journal, April, 1831, vol. xx. 50 51.

founded only on the known courses of the storms in that region, which I had pointed out? It may be possible that Mr. Espy has not well acquainted himself with the various directions and anomalies of the trade winds in these regions; especially with the general movements of these winds as exhibited below the medium height of the clouds: although I admit, that the very lowest or *surface* current of these winds, is most frequently northeasterly. But that which he appears to call "the uppermost current," has, in these latitudes, been generally reported from the S.W. quarter; and as a mere *upper current*, let me add, would be as likely to control the direction of these storms while in the West Indies, as in the United States.

Although unpractised in controversial discussion, it has been my design, in this defensive appeal, to treat Mr. Espy's pretensions with fairness, as well as with particularity; such as the importance of the issue appears to demand; and I have regretted that he did not consider it desirable to confine the discussion to a few of the most important and distinguishing facts and characteristics which are alone necessary to a decision of the question.

It appears to have been established by my inquiries, that there is a line pertaining to the interior path of a violent storm, on one side of which, the changes presented in the direction of the wind are in the order from left to right, coinciding with the apparent course of the sun in northern latitudes: while, on the other side of this line, the order of change presented by the wind is against the sun, or from right to left. Now, if on and immediately contiguous to, this line, the direction of the gale previous to its crisis and change of direction, be found opposite to the course of the storm, i. e. in the direction which is retrograde, but parallel to its line of progress, in accordance with the centripetal theory, then the case must go for Mr. Espy. But if the direction of the wind on and near this line, previous to the crisis and change of the storm, be found in a direction which is *transverse* to the general course of the gale or its line of progress, in conformity with the theory of a whirlwind, then the *rotary* action of the gale is established. The approximate accuracy with which the line of the axis or pivot of the storm, may sometimes be fixed, and the extremely divergent character of the winds here specified, render the question, in such cases, of easy determination; and for testing the two theories, it was unnecessary to extend the inquiry or discussion beyond this single and tangible point.*

There is still another and conclusive test for the two theories in their application to storms. It must be obvious, that if Mr. Espy's centripetal theory be the true one, then the various directions of wind in a storm will as well correspond with a whirlwind turning to the *right*, as with one turning to the *left;* and one course of rotation can as readily be made out from the facts collected, as the other. Now, I invite Mr. Espy to apply this rule of examination to the storm of 1821, and also to the various storms which are noticed in the work of Col. Reid. True it is, that on the whirlwind theory, this other result would require every wind to be reversed in its direction; but, if Mr. Espy is right, no such reversal will be necessa-

* This test will apply equally to the traces or prostrations in the paths of tornadoes; or, if these be the effects of a wind blowing from all sides directly towards the centre of the tornado, then the predominant effects of the wind *in the centre of its path,* will be found *parallel* to its course;—but if the effects here, be *transverse* to the line of progress, then the prostration was occasioned by a whirlwind: no matter in which of the transverse, or longitudinal, directions the effects may have been produced.

ry; for in such cases the reported direction of the several winds at various places will be found to correspond as well with one direction of rotation as with the opposite; both being equally remote from his centripetal theory.

Let the advocates of the latter, who remain unsatisfied, make this trial, with our figures before them.*

An argument for the theory of rotation may be found in those sudden irregularities and in the light and uncertain winds which are sometimes exhibited near the centre of a storm; for, on the centripetal theory, the relative condition of this portion of the storm would appear liable to little change. But, in a whirlwind storm, the winds will be found to have an axis of *progression*, as well as an axis of rotation. These axes cannot coincide in their path, but the former will be found considerably to the left of the latter, or on the coast of the United States, further to the N.W. We see here a cause for many of the anomalies and irregularities of action which are found near the centre of a gale; and which, according to the centripetal theory, would not be likely to occur.

Another argument for the whirlwind theory, is found in the increasing and sometimes very extensive expansion of the lull of the storm, particularly in greatly extended storms, where the passage of the central lull, and the continual depression of the barometer, is sometimes of more than a day's duration. This appears to be due to the centrifugal influence of the rotary action; but it is difficult to perceive how this enlargement of the central lull under a continued barometric depression, can be reconciled with the centripetal theory.

In comparing the accounts of the storm of 1821, the inquiring reader will hardly have failed to notice the unequal force and duration of the westerly winds which closed the storm, as compared with the more generally violent and longer continued winds from the eastern board. This peculiarity frequently attends the development of our coast storms, which sweep, as in this case, partly over the sea and partly over the land; and seems to be due to the greater obstructions which are offered to the gale by the continental surface. The results seem accordant, however, with a generally circuitous action; these westerly winds, at least the south-westerly, being often found strongest at a distance from the coast.

Observations made on well developed storms of a later date than that which has been considered, have shown the distinguishing characteristics of the whirlwind storm. On the line of lull in the centre of the storm, the wind has been observed to set in, not contrary to the course of the storm, according to Mr. Espy's theory, but more nearly at right angles to this course, and continuing with increasing violence in nearly this direction, till the arrival of the lull; after which the wind commences to blow, more or less suddenly, from nearly the opposite point of the compass, and continues in that direction till the close of the gale. Such was the storm of April 28th, 1835, at New York, on which observations were made with great care. These and like observations would appear to be entirely conclusive of the question.

I have never known a storm in which the line of the central lull has corresponded to that of an initial wind blowing opposite to the course of the storm, and the lull followed by an equally strong wind from the opposite

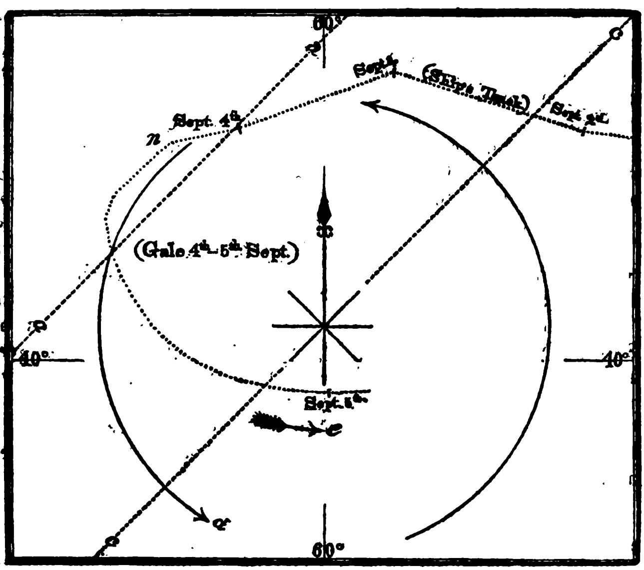
* The facts necessary for this examination, as relates to the storm of 1821, are found in this Journal for March, 1839, p. 153—158. This test is too important to be omitted by those who remain in doubt on this subject.

quarter, blowing parallel to the progress of the storm; nor am I yet prepared to believe that such a case can be produced.

In illustration of the rotary character of the Atlantic gales, I present here the case of a N.E. gale which was encountered at sea on the 4th of September last, off the Sable Bank. This storm, like three others which immediately followed, passed at sea, not far from our coast, and apparently on a track leading far to the northward. The account was kindly furnished by Thomas H. Sumner, Esq., master of the ship Cabot, and was drawn up by him soon after the close of the gale. At noon on the 4th, the ship's latitude by double altitudes, was 42° 12′ N., lon. 61° 5′ W., ship steering W.N.W., and the wind at N.E., soon increasing to a severe gale. At 4 P. M., reduced to close reefs. The gale had now so increased that it was deemed hazardous to heave too, and the ship was kept before the wind; which gradually hauled to the N. At 11h. 30m. P. M., it was a perfect hurricane. At 2 A. M., [6 A. M.?] the wind had hauled round to W.N.W., and at 2 P. M., the storm had so far abated that the ship resumed her course. Lat. at noon on the 5th, 39° 39′ N., lon. 59° 59′ W. The following are the approximate courses from the log book from noon on the 4th, to noon on the 5th, corrected for variation.

Courses.	Hours.	Distance.	Courses.	Hours.	Distance.
W.b. S.	4	40 miles.	S.E. b. S.	2	22 miles.
W.S.W.	1	10 "	S.E.	2	21 "
S.W.½W.	4	44 "	E.S.E.	2	20 "
S. b. W.	1	11 "	E. b. S.	4	40 "
S. b. E.	2	24 "	E. b. S.	2	18 "
					250 miles.

The winds during this period, as since taken by me from the log-book, were N.E., N.N.E., N., N.N.W., N.W. b. W., W.N.W., and W. b. N.



I annex here a figure showing the track of the ship previous to, and dur-

ing, the gale. The line *a a* will represent the general route of the centre of the storm, according to the centripetal theory, but, viewed as a whirlwind, the centre may have passed near the line *c*, c. In plotting the courses, an approximate correction is made for the angles resulting from a reference of the course to the points of the compass, and also, for the heading off and continued set of the Gulf Stream. The curved wind arrows are drawn from a fixed centre, but owing to the continued progress of the centre with the body of the storm, it may be presumed that the direction of wind represented at *d*, would, from this cause, have been carried forward in its position; as for example, at *e*, or to a more advanced position.

Had the N.E. wind here, been at or near the centre of the storm according to the centripetal theory, not only would the ship have been met, perhaps after a lull, with a violent wind from the S.W., but a large portion of the ship's track, from 4 P. M. on the 4th, would probably have fallen under the *easterly* winds, which, upon this theory, belong to the opposite portion of the storm; by which the ship would again have been driven to the westward. But the continued curvature of the ship's track, while running before the wind for so great a distance eastward, appears to demonstrate that the storm was of a rotary character, whirling to the left.

Did our space permit, I might here notice in a more particular manner, the "examination" of Col. Reid's work which Mr. Espy has attempted in the January No. of this Journal. The survey which has here been taken of his examination of the storm of 1821, may serve, however, to illustrate the extent of his misconceptions in analogous cases. We are also furnished by Mr. E. himself, with a key to the illusion under which he appears to have fallen in regard to these storms. He says:

"On reading the logs of the several ships, I kept the map of the particular storm open before me, and drew my pencil across the point where the ship was, drawing an arrow so as to exhibit to the eye which way the wind was blowing at that time in that locality. When several logs were read, and arrows made in every locality, I was not a little pleased to see, in all the storms, decided proofs of an inward motion of the air." January No., p. 39.

This fallacy is also brought before the eye of his reader, in various figures inserted in the same paper, and appears to have had a controlling influence upon his mind from the beginning of his inquiries.

Perhaps it is not generally understood, that the traces of the action of an ordinary whirlwind, as found in the prostration of corn, and other objects, along its path, always point inward, and at first view appear not greatly unlike the action of two parallel lines of opposing winds blowing simultaneously towards each other. From causes which I think are obvious, this effect is more strikingly exhibited in small tornadoes, than in large storms of the whirlwind character; but the *coup de œil* of the effects marking the various and successive directions of the wind, when thus blended together, is, in the latter case, not unlike the former. But a careful analysis of these effects, with proper attention to the order of time, place, and succession, will not fail to demonstrate a circuitous or whirling action.

These effects were well exhibited in the track of the New Brunswick tornado, (N. J.) of June, 1835; and which corresponded to those which I have examined in the tracks of several other tornadoes of like character: and if there be any effects which amount to a demonstration of a constant whirling movement in the wind, they are certainly to be found in these appearances. Small whirlwinds, exhibiting like traces, have sometimes passed

under observation and the entire circuit of gyration been fully taken in by the eye. These peculiarities of aerial motion have been noticed from time immemorial, and have been clearly designated by terms which seem to have found their way into all languages, through all ages. But according to the discoveries of Mr. Espy, founded, perhaps, on these inward appearances, the observations in all ages, on which these terms have been founded, could have amounted to little else than an ocular deception; and an obvious whirlwind can be no whirlwind, after all! but, strange to say, the wind in such cases has blown from all sides, almost, if not directly, inward,—each part opposing every other part in its onward motion, until compelled, for want of room, to turn directly upward in an ascending column; or, perhaps, I should say, *drawn* upward by a principle of calorific levity! To say nothing here of the physical impracticability of continued movements of portions of contiguous atmosphere in opposing directions, I would suggest to the advocates of this centripetal theory, to inquire whether these inward appearances, on which they rely, are not the necessary results of whirlwind action, and such as are uniformly exhibited in the path of destructive whirlwinds? Notwithstanding the illusion of these inward appearances, it will be found that each single effect, when plotted in connexion with other effects which were produced *at the same instant of time*, may serve to demonstrate the whirling action.*

The great mass of interesting facts, and the clearness of the illustrations found in the work of Col. Reid, are such, however, as will probably carry conviction to all minds not preoccupied by opposing theories or opinions: and it is not probable that the valuable developments of the law of storms which are found in his work, can be obscured or set aside by the opposing views and labours of his ingenious but mistaken examiner.

It was my intention to have introduced here, some further remarks on the errors or fallacies which are apparent in Mr. Espy's reports on various other storms, as chairman of the joint committee on meteorology; but the space which has been already occupied, renders it necessary to relinquish this design. I would however, notice in passing, that his selection of these storms has not often fallen upon those of a strongly marked character and in such a field of action, as would leave little room for mistaken or imaginary inferences; that in no case, save the last reported, has the collection and development of the facts, been such as the character and objects of the committee seemed to demand; and that in nearly all of the *twelve* cases, thus put forward and relied on by Mr. Espy, there has appeared, on examination, sufficient evidence for the refutation of his peculiar positions.

The most important and creditable of these labours of Mr. Espy, relate to the two storms which simultaneously visited our sea coast and interior, on or about the 17th of March, 1838. This coast storm Mr. E. has blended with the fall of snow and rain which appears to have prevailed over a large interior portion of the United States at the same period, attended by no remarkable development of wind, and a like moderate effect upon the barometer; and which, on its arrival near the coast, appears to have blended with the smaller and more strongly developed storm or gale which was then sweeping along our seaboard. The latter, favoured probably in the action of its north-western limb by the diffusing and concurrent action of the in-

* I do not here notice the involuted spiral course of the wind inward and upward, in these tornadoes; not deeming it necessary to the illustration of the points now at issue.

land storm, exhibited its N.E. wind with unusual violence. But in place of the continued and strong north-westerly wind, which, in regular and well developed storms, immediately follows, *the barometer remained depressed, and no westerly gale followed.* But in the few marine accounts given by Mr. Espy, the development of a westerly gale on the opposite limb of the coast storm, off at sea, was clearly distinguishable; with other marked characteristics of a whirlwind storm.

These general conclusions, I think, will be obvious from even a cursory examination of Mr. Espy's chart and evidence illustrating this storm, at least to those who are accustomed to examine the phenomena of the whirlwind storms; and it will readily be seen, that the violent N.E. gale near the seaboard, was of a different character from the more general inland storm; as is apparent also from the greater fall of the barometer near the coast; which is always found to be greatest near the true centre of the gale.

There are two important facts connected with the development of this storm, as exhibited by Mr. Espy, which have strong claims to the attention of those who advocate the centripetal theory. The first is, that the collection and arrangement of the evidence relating to the course of the winds and their delineation upon the map, has brought Mr. Espy to acknowledge "that there is no one point at which all the arrows, if prolonged, would meet;" one arrow pointing to "somewhere in North Carolina," and another to "somewhere near the N. part of the storm."* He would fain believe, however, that certain of the strong exterior winds would meet "very little S. of the centre," and in conformity with his theory. But it is difficult to see how this storm, as developed by him, can afford any support to his peculiar views; and he obviously overlooks the connexion of the N.E. wind, E. of the Alleghanies, with the storm which was sweeping along the coast, and which was made apparent by a report of the gale at W.S.W., two and three days before arriving at the Capes, by the ship Sabina, at Philadelphia.

It is a fact equally remarkable, that if we set one foot of a pair of dividers upon the central point which Mr. Espy has marked for the storm of the 17th, and, with a pencil at the other foot, sweep through the several geographical points in and near the field of his storm, W. of the Alleghanies, we shall then find that the direction of the wind in the places from which reports are given, appears to correspond with *a great circuit, or whirlwind, turning to the left.*

Now, when we consider the diversity of surface and position in this great inland region; the distances and the inequalities of elevation, which in some cases might expose the locality to the action of other strata of winds; and the disturbance of direction which possibly might have resulted from the contiguity or influence of the violent coast storm, together with the liability to inaccuracy in the reported observations; this result may well be considered not only as remarkable, but of great value.

The reader is invited to test the examination in the manner mentioned, at the following localities, as they are numbered on the chart which Mr. Espy has attached to the report under consideration, viz.

Locality No. 6. On the 16th and 17th March.	Locality No. 14. On the P.M. of 17th.
	" 15. " 17th.
Locality No. 7. On the 16th and forenoon of 17th.	" 17. " 17th.
	" 18. " 17th.

* Journ. Frank. Inst., Oct. 1838, vol. xxii, p. 224.

Locality No. 11.	On the 17th.		Locality No. 20.	On the P.M. of 17th.	
" 12.	" 17th.		" 27.	" 17th.	
" 13.	" 17th.		" 28.	" 17th.	

These, I believe, comprehend *all* the reports from localities within or near his field of the storm for the 16th and 17th, except that portion which falls within his circle for the storm of the 18th, which is omitted for the reason specified. In three of the above cases only, is it found necessary to make a distinction between the winds of the morning and evening, and if the whole were to be referred to noon on the 17th, it is not improbable that the coincidences would be entire. The most divergent direction of the wind from a circle which I have here found, according to the wind arrows on the chart, comes very much nearer the circuitous or whirlwind movement, than towards the central point marked for the 17th, or any other approximate geographical centre. It should be remembered, that these localities are scattered over a range of country extending from near Lake Ontario to the northern extremity of Alabama, and from the Alleghany Mountains to the middle portions of Indiana.

If we now examine, by a like test, the reports from localities which remain in the field assigned for the storm on the 18th, we shall also find a large portion of cases in which the direction of wind conforms, mainly, to an axis of rotation moving eastward along the coast. But as these reports relate chiefly to the storm of the seaboard, with which the land storm had become blended, I forbear to enter upon a more extended analysis.

We cannot suspect Mr. Espy of having developed these facts for the purpose of sustaining the whirlwind theory of storms; and these results, though still imperfect, may serve to show the value of careful and widely extended observations, when collected and brought into view, as in this report. Ill chosen, as I think was this storm, for the object of deciding the important question which Mr. E. has raised, yet the facts thus obtained and developed in relation to a complicated and somewhat anomalous exhibition of weather, such as is not unfrequently found in these latitudes, are none the less valuable in meteorology: and I hope to see many such efforts on the part of Mr. Espy and the able committee to which he acts as meteorologist. I will only add here, that I have been able to collect additional information relating to the above storm; having extended the inquiry in various directions at sea, as far eastward as the bank of Newfoundland.

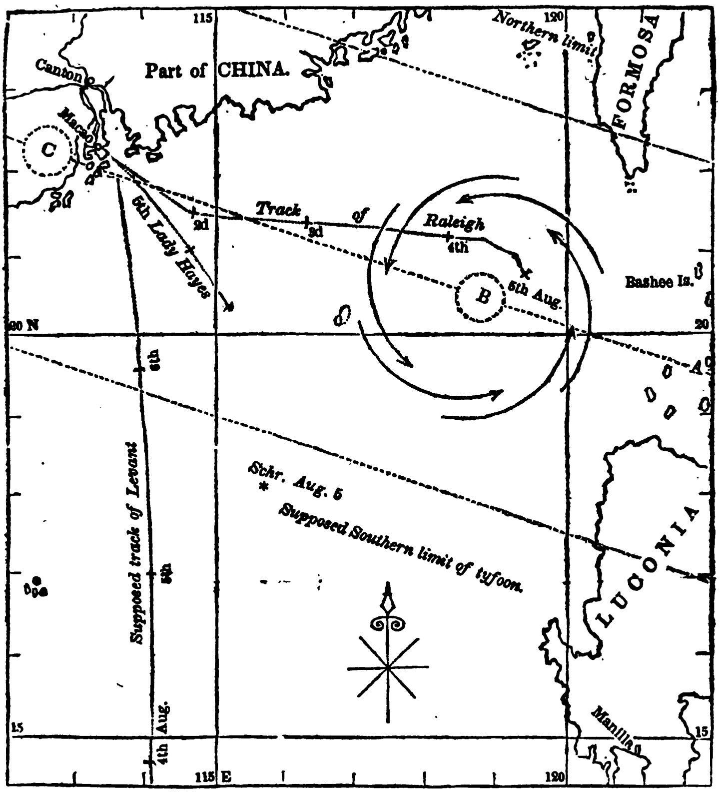
New York, May 18, 1839.

POSTSCRIPT.

Since the above was sent to press, the continuation of Mr. Espy's examination of Col. Reid's work, &c. has appeared in the April number of this Journal. The character of this additional matter appears, however, to correspond so nearly with that relating to the storm of 1821, which we have now reviewed, as hardly to require any further reply; except as the present opportunity may seem to invite a passing notice. In his further notices of Col. Reid's storms, we again observe the continued blending of the phenomena which pertain to different periods of a storm, into one forced connexion, as if occurring at the same moment of time, and which is best refuted by the reading of Col. Reid's book, and an attentive consideration of the facts which are there recorded.

In copying my evidence respecting the Raleigh's tyfoon in the China Sea, which had also been noticed by Col. Reid, Mr. E. has neglected to

present his readers with the geographical sketch by which it was accompanied; which is here inserted. By referring to this map, in connexion with the annexed synopsis of the evidence, the reader may determine for himself the rotative character of this hurricane: although Mr. E. confounds with the regular action of the storm, the light N.W. wind which preceded the gale at Canton, and the S.E. wind by which it was followed.*



From the evidence which I have collected relating to the storm, we arrive at the following facts:

1. That the Raleigh met a gale which set in with the wind at N., veering round by the E., to S.E. and S.

2. That at the harbours and roadsteads inside, (Macao, Kumsingmoon, &c.) as well as at Canton, the gale occurred at a later period, and the wind also set in at N. and *veered* to E. and S.E., in a manner similar to that reported by the Raleigh.

3. That with the ship Lady Hayes, off the islands at the mouth of Canton river, the wind also set in at N.; but the ship steering S.E. by E. under a

* On this map, the track of the Levant was laid down by estimate, before Captain Dumaresq's Journal was received, and should have appeared somewhat further to the westward. The position of the Levant at noon on the 6th, was a few miles N.W. of the position indicated on the map.

press of sail, (and doubtless falling off from this course with the heavy sea from the eastward,) the wind, towards the middle of the gale, began to veer towards the W., whence it drew round to S., towards the close of the gale.

4. That the violence of the wind was greater with the Raleigh than with the Lady Hayes.

5. That the gale was experienced by an English schooner, August 5, in lat. 18° 2′ N., lon. 115° 50′ E.: but the American ship Levant, which arrived in Canton river on the 7th, from the southward, did not encounter the gale.

6. That the fall and rise of the barometer at Macao and with the Raleigh, and the strength and changes of the wind with the latter, were such as are often exhibited near the centre of a hurricane; and that the minimum depression of the barometer occurred about *seventeen hours later* at Macao than with the Raleigh.

These facts seem to establish the following conclusions:

1. That the tyfoon advanced in a westerly direction.

2. Negatively;—that it did *not* pass through the China Sea, from N.E. to S.W., nor on the opposite of this course.*

3. That it was a *progressive whirlwind storm*, turning to the *left*, around its axis of rotation.

4. That its centre of rotation passed to the *northward* of the Lady Hayes, and to the *southward* of the Raleigh and of Canton; and nearly on the line A, B, C, as marked on our chart.

5. That its rate of progress was about 17 miles per hour.

6. That the extent or diameter of the violent part of the gale, as deduced from its duration and rate of progress, was about 400 nautical miles, or equal to six or seven degrees of latitude.

7. That the latter induction accords with the geographical evidence which has been obtained of the visitation of the storm.†

The fall of the barometer in these storms, I have considered as resulting from their rotative action; but Mr. Espy here asserts that it cannot be due to this cause, and for proof, he refers us to his speculations on this subject. But facts are more to be relied on than speculations, and as furnished by himself, on several occasions, they appear to be conclusive against his position. He asserts, "that it would require an *outward* motion of the air from the centre, of 240 feet per second, to make the barometer fall an inch;" but every person who has observed the action of a vortex, and the depression which the rotary motion occasions at its centre, may know this to be an error, and that no such *outward* motion is necessary for diminishing the central pressure.

In professing his acceptance of the test which I had suggested for his theory, as applicable to storms in the West Indies, and to those moving N.E. on the coast of the United States, Mr. Espy wishes me to concede, that when "the wind sets in at N.E. in storms on our coast, it never can change round to N.W.," which change he asserts to be irreconcilable with the whirlwind theory. But this cannot avail, for such changes, which every observer has noticed, certainly cannot be considered as sustaining his centripetal theory. This appears, however, to be the most plausible of his

* A writer in the London Nautical Magazine had ascribed a S.W. course to this tyfoon.

† Vide Silliman's Journal for January, 1839, vol. xxv., p. 209—219; or London Naut. Mag. for January, 1839.

positions, and is grounded on his confident, but impracticable, reference to the "*extreme border*" of a storm, which has already been noticed. There is, evidently, much relating to this matter which Mr. E. fails to comprehend. It is obvious, however, that when a great gale has "set in" at N.E. on our coast, the "extreme border," or influence of the storm in the atmosphere, has already advanced far beyond the observer: it may even have advanced to the distance of some hundreds of miles; as has been seen in illustrating the phenomena which were noticed by Dr. Mitchell.

It had been well for Mr. Espy, if, in applying the proposed test to storms on this coast, he could have found one storm which would have sustained his centripetal theory. He refers us, indeed, to the "numerous examples" which he had already given in the storm of 1821, as "harmonizing" with his theory; but with the true character of this harmony, the reader is already acquainted. In further seeking for facts to sustain his theory under this test, instead of taking cognizance of storms, "as they move in a N.E. direction along the coast of the United States," according to its terms, he has only referred us to certain facts, (perhaps anomalous) relating to Col. Reid's storm of the middle of August, 1837, which are derived from the log books of the Ida, Rawlins, Yolof, and Duke of Manchester; facts which occurred on and near the latitude of 30°, where the storm is rapidly changing its course of progression, and which are therefore inapplicable to either branch of the test which I had presented. I can see no reason, therefore, why these cases should have been adduced, except for want of better, while it can readily be shown that these selected cases are quite at variance with the centripetal theory.

It had also been fortunate for Mr. Espy, if in accepting the test for the storms in the West Indies, he could have furnished one clear instance of a hurricane's blowing from W.N.W. or N.W. without material change, until the appearance of the central lull, and then, resuming its violence from the opposite or S.E. quarter, till the close of the gale. If his theory of centripetal storms had been well founded, it would have been easy to have produced at least a dozen such cases. But, when the generalization made by Edwards at Jamaica, that "all hurricanes begin from the N., and veer back to the W.N.W. and S.S.W."—and that "when got round to S.E. the foul weather breaks up,"—is gravely adduced by Mr. Espy, with other facts of like character, as fulfilling the conditions of the test which I had proposed, it becomes evident that there are no facts to be found which can sustain his theory. It may be seen by referring to our figures in the early part of this communication, and adapting them to a *north-westerly* course of the storm, and also by our map and figure relating to the storm in the China Sea, which pursued the same direction, that the setting in of the hurricane at N. in the latitudes of the West Indies, and its *veering* from that point round to W.N.W., and so on through S.S.W. till it ends in the natural current from the S.E. by which the storm is driven forward, is entirely at variance with his centripetal theory, as applied to the centre of the storm's path in these latitudes; while the direction and changes above described are in full accordance with the other facts by which these hurricanes are proved to be great whirlwinds, spinning to the left, and advancing, in the latitudes referred to, in nearly a W.N.W. direction.

I have reason to hope that the expositions which have now been given, will tend, in some degree, to quiet the apprehensions expressed by Mr. Espy in relation to those rules for the practical navigator which are founded, not

on a mere theoretical basis, but on those important *facts* relating to storms, which have recently been brought into view.

Bibliographical Notice.

Popular Lectures on Geology, treated in a very comprehensive manner. By K. C. Von Leonard, *Professor at the University of Heidelberg, in Germany. With illustrative engravings. Translated by the Rev.* J. G. Morris, *A. M., and Edited by Prof.* F. Hall, *M. D. Baltimore: Published by N. Hickman.*

We have received the first number of the above work, containing 100 pages, 12mo; and others are to issue as soon as they can be prepared for the press. The author of these lectures is well and advantageously known by his publications on Geology, and the kindred departments of science. The lectures which the translator and editor are now presenting to the American public, were delivered with the laudable intention of giving a popular view of a science of modern creation, but of the highest interest, as it has rendered familiar to the philosopher the nature and history of those successive events which, in the order of Providence, were necessary, and intended to bring the globe which we inhabit from its original chaotic state into that condition by which it was fitted to become the habitation of moral and intellectual beings. Were we to attempt to enumerate the discoveries, and the fair and necessary inductions of the Geologist, they would, to most of those who have not made the science a study, appear to be the creations of fancy, rather than the legitimate conclusions of sober judgment, under the guidance of sound philosophy. It is not only right, therefore, but is most praiseworthy, for the cultivators of this, as well as of other, departments of science, not only to enlarge its boundaries, but to diffuse a knowledge of it by presenting it to the public under an aspect the most familiar and attractive of which it is susceptible.

It appears that popular introductions to geology were almost unknown in Germany prior to this publication, although there are many such in France, England, and our own country; some of these have great merit, whilst others are from the hands of the mere manufacturers of school manuals, the productions of persons much better acquainted with the book market than with the science which they pretend to render familiar. We hail the work before us with pleasure, as the production of a philosopher of a vigorous mind, fully imbued with a knowledge of the subject matter with which his pen is occupied. It is no easy task, however, for one who has rendered himself familiar with the higher departments of any branch of science, to descend sufficiently from his elevation to conduct the inquirer in his first steps; it is in this point that such attempts, most frequently, fail, and from this objection the work before us is not entirely exempt. The published number contains three lectures; the first is devoted, principally, to the subject of mining, including its connexion with geology, and containing a general notice of mines, miners, and mining operations, illustrated by thirteen engravings on wood. We have read this lecture with much gratification; its history and its anecdotes are well calculated to induce in the reader a de-

sire to learn more upon that subject, which may be said to lie at the foundation of all our improvements in other branches of knowledge.

The second lecture is on the *Sciences auxiliary to Geology. Natural Philosophy, Chemistry, Mineralogy, General properties of bodies, with observations on Light, Heat, Electricity, Galvanism, Magnetism, and Thermo Magnetism.* The third is on *Chemical Phenomena, Elements, Oxygen, Hydrogen, Nitrogen, Carbon, Sulphur, Chlorine, Fluorine, Phosphorus, &c.* In these two last lectures more has been attempted than it was possible to accomplish in the space devoted to the subjects above enumerated; some of these are in their nature too recondite for brief explanation, and where such explanation is unsuccessfully attempted, the result is absolutely injurious; probably there are some obscurities in the translation which may not be chargeable on the original, but of this we have not the means of forming a judgment. In the definition of Natural Philosophy, p. 48, we are told that "Natural Philosophy investigates the changes which occur in inanimate bodies, and the laws which regulate those changes;" now this would answer rather better for a definition of Chemistry than of Natural Philosophy. We are told, p. 50, that "some of the *general peculiarities* of bodies are Extension, Impenetrability, Divisibility, Vis Inertia, Mobility, and Porosity." For designating those *general properties* which are common to all bodies, and without which we cannot conceive of their existence, "general *peculiarities*" is a very badly chosen term. "Porosity," although, in fact, a common property of bodies, does not appear to be essential to matter, and might have been advantageously omitted; porosity may more properly be considered as an accidental than a necessary condition of matter. In speaking of Extension as that property of a body by which it occupies space, we are told, p. 50, that "the usual expression employed to designate the space is *volume;*" now this term, most certainly, appertains to the body, and is not correctly used to designate the space occupied by it. We are informed, p. 61, that "the method of making ice, and cooling water in hot climates, depends on the principles of the conduction of heat," and then follows, by way of illustration, an account of the mode of making ice in Bengal; in which process the effect is due, exclusively and entirely, to radiation and evaporation, without the most remote connexion with *conduction.* At p. 63, it is said that "Water, when frozen to ice, loses its caloric and becomes lighter; hence ice, though a solid body, swims on the surface of water;" to the uninstructed, this paragraph would convey the idea that the ice became lighter in consequence of the loss of its caloric; and that the ice actually weighed less than the water from which it was produced, neither of which is the fact, as the intelligent author must have known. We are also informed, on the same page, that "heat necessarily escapes whilst the water is undergoing the process of freezing, and it arises in the form of vapour." This is both vague and incorrect; heat cannot assume the form of vapour, although it may convert liquids or solids into that state. There are several other inaccuracies touching the nature and action of caloric. Speaking of the electric spark, p. 68, we are informed that "it is by these sparks, which, with the imperfect apparatus originally used, could scarcely be made visible, that electricity has been rendered one of the most wonderful agents in nature." A more awkward and incorrect manner of expressing the fact that the electric fluid is such an agent, could not be well devised. In speaking of conductors of electricity, p. 69, it is said, "Thus metals, water, and other substances, receive electricity by *induction,*" meaning, we suppose, conduction; this most probably is an error of the press, but it is not noticed

in the *errata.* On other points relating to chemical phenomena, a considerable number of inaccuracies occur, which we have neither space nor disposition to point out; our main object being to show the necessity of greater care in the future numbers. There will, we apprehend, be little danger of the recurrence of such inaccuracies when the subject of Geology, the main object of the lectures, is on the tapis, and we anticipate much pleasure from the perusal of the future numbers of this work, as we have no doubt that they will tend equally to excite and to gratify a taste for this department of science.

The Editor has pointed out some inaccuracies in the original text, and has added, in the form of notes, several facts and observations which increase the value of the work.

Franklin Institute.

Sixty-first Quarterly Report of the Board of Managers.

The Board of Managers respectfully submit to the members of the Franklin Institute their report for the last quarter.

The lectures of the Institute closed on the 10th inst., having been, as usual, well attended, and having afforded high satisfaction to the large class which they drew together. The Board renew the expression of their thanks to the able lecturers on Chemistry, Natural Philosophy, and Technology, to whose efforts the success of the courses is due. They cannot but regret that it has not yet proved practicable to carry into effect the arrangements for extending the accommodations of the Institute, by which greater comfort would be secured for those who attend the lectures, and the lectures themselves be opened more widely to the public. The taste which the courses of the Institute has, in so great a degree, tended to diffuse throughout our community, for scientific lectures, goes on increasing in a rapid ratio, and the Board feel confident would, even now, more than justify a considerable extension of the present means to satisfy the demand. The schools of the institution have been as successful, in their way, as the lectures, and the Board feel pleasure in expressing their sense of the abilities and zeal of the teachers of ornamental, mechanical, and architectural drawing. The want of more extended accommodation for the schools is, also, severely felt.

The Journal of the Institute, under the editorship of Dr. Thomas P. Jones, with the assistance of Professor John Griscom, continues to merit and to receive the patronage of the members and of the public. The number of exchanges with domestic and foreign journals, particularly with the latter, and of subscriptions has been considerably increased, furnishing not only an additional opportunity for the selection of interesting matter for the Journal, but going also to increase the supplies for our library and reading room. These two departments continue favourite ones with the members, and are among the most useful of the institution. Several valuable additions have been made to the library by donation during the past quarter, and many by purchase. The deficiencies existing in some of the sets of foreign periodicals have been nearly all supplied.

The other collections of the Institute are increasing. The cabinet of minerals is now entirely arranged, and labeled, and by the aid of a catalogue marking the deficiencies in species, we shall have an opportunity of completing this already valuable collection. The cabinet of models re-

quires more room for the display of the articles, and a place of easier access than at present. The Board believe that when these conditions shall be realized, the collection will rapidly increase by donations. We want an extensive collection of raw materials and products of art, or a technological collection, in the widest sense of the term, and no institution in our country possesses more favourable opportunites of obtaining such, when we can furnish mechanics and manufacturers a suitable opportunity for the permanent display of their products.

The Committee on Premiums and Exhibitions have nearly completed the arduous task of preparing their report upon the articles submitted last autumn for examination. The care which is always exercised in the awards made by the Committee, necessarily delays their report, and on this occasion the very great number of articles brought forward, has increased the delay beyond what is usual. The Board are pleased to be able to state that the report of the Committee will very soon be in a state to submit to the members.

The Committee of Science and the Arts have pursued their usual useful labours. Inventors, though frequently disappointed in the result of the cool judgment by the practical and scientific men composing the sub-committees, have the candour sometimes to commend the good advice which they receive. Many thanks are due to these members who devote valuable time to labours, the results of which very frequently do not appear before the public, and who are thus deprived of a powerful stimulus to exertion in the appreciation by the public of their useful labours.

Since the last report, the award of two Scott's legacy premiums has been recommended, and a sub-committee is now engaged in examining such articles submitted at the last exhibition as may be returned for the purpose of competing for this premium. The Board learn that the die for the medals which are to accompany the premiums, an appropriation for which has been authorized by our City Councils, is in preparation, and hope soon to be able to submit it to the inspection of the members. By reference to the conditions of the award of these premiums, it will be seen that they are liberal, and intended to render their attainment by meritorious inventions as easy as possible.

The monthly meetings have been revived lately under the charge of a committee from the Institute, with the spirit which formerly characterized them; and the attendance has increased at once with the efforts to present attractions to the members.

The Board have still to regret the failure of the appropriation in the Legislature of our State, for establishing a School of Arts. It is truly remarkable that in a state like ours, so dependent upon mechanical industry for its prosperity, the importance of establishing a school in which the principles of science bearing upon the arts, should be taught to young mechanics, in the way, and within the time, suited to their business, should not be so generally admitted, as to secure the cordial co-operation of the Legislature. The Board continue to keep this important object steadily in view, and hope that public opinion will ultimately set so strongly in favour of the School of Arts as to be irresistible.

In conclusion, the Board congratulate the members of the Franklin Institute on the continued prosperity of the Institution.

The following named gentlemen have become life members during the

present quarter: Hector Orr, Edward Miller, Ellwood Morris, Richard C. See, and Jos. M. Truman.

The Treasurer's account is herewith submitted.

JOHN AGNEW, Chairman.

WILLIAM HAMILTON, Actuary.

April 17, 1839.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on E. Tilghman's Railway Bar.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination an improved Railway Bar, invented by Mr. Edward Tilghman, of Philadelphia, Penn., REPORT:—

That "the nature of the improvement consists in so forming the bar that there shall be a reduction of the height usually given to the ⊥ rail between its head and the base on which it rests: thereby diminishing the leverage of the rail, while its strength and capability of being firmly secured to the cross tie, are provided for by the addition of a rib directly under the centre of the base, which rib may be made plain, trapezoidal, or with a lower web.

To fasten the rail, the lower rib is inserted in the cross ties, and wedged securely to its place, where it is supported conjointly upon the ordinary base, and the under part of the lower web. A chair, or flat plate of iron, is inserted immediately under the upper base, or support, to receive which, notches are made in the ends of the bars, so that when two of them are put together, these notches form a mortise through which the chair is to be inserted. The chair is affixed to the cross ties" by spikes or screws.

The Committee having tested the strength of the improved *trapezoidal* rail, weight 48 lbs. per yard, by the rules laid down by Professor Barlow in his account of "Experiments on the transverse strength and other properties of malleable iron, with reference to its uses for railway bars," feel satisfied it will sustain a weight of from six to seven tons without injury, (the supports being 33 inches apart) or about 75 per cent. more than the most approved rail of similar weight now in use.

With reference to *leverage*, the improved rail is decidedly preferable to the ⊥ rail, the distance between the upper surface and support being considerably less, and as its entire depth is greater than that of any other rail known to the Committee, (and may be increased at a slight expense without changing the position of the main support, or increasing the leverage,) it consequently follows, as the depth governs the deflexion, that the improved rail is much the most stiff and rigid.

In point of economy, the Committee are of opinion that the improved *trapezoidal* rail will be found less expensive than the ⊥ rail. The plan suggested for connecting the bars, and attaching them to the sills, they conceive permanent and simple.

By order of the Committee.

WILLIAM HAMILTON, Actuary.

March 14, 1839.

Report on Eastwick & Harrison's Eight Wheel Locomotives.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, to whom was referred for examination Messrs. Eastwick & Harrison's Eight Wheel Locomotives, REPORT:—

That these engines possess two peculiarities of an important character; one in the arrangement of the driving wheels, and the other in the mode of maintaining the fire draft.

It is well known to engineers, that the efficiency of the locomotive engine depends, first upon the quantity of steam which the boiler may be capable of generating in a given time, and secondly on the amount of friction, or, as it is technically termed, adhesion, between the driving wheels and the road. As the adhesion increases with the weight, it is evident that the engine becomes more effective by increasing its weight, and by throwing a greater proportion of this weight on the drivers.

But a limit to this increase of weight arises from the incapacity of the road to sustain the great pressure thus thrown on a small bearing surface.

To obviate this difficulty, engines have been made with all the wheels coupled so as to constitute them all drivers, and thus distribute the *adhesive* pressure over a greater extent of the road.

Engines of this description are used for heavy and slow draught, but are considered unsafe, from their liability to be thrown off the track at curves.

Another plan, patented a few years back by an engineer of this city, was to use four drivers, and at the same time to carry the front end of the engine on a guide truck, as in the six wheeled engine. But here a new difficulty arose in consequence of the engine having three points of bearing in the line of the rails, on which its weight could not be properly distributed, unless the road was entirely free from irregularities of surface: a condition not to be found on any of the roads which have come under the notice of the Committee.

The improvement invented by Messrs. Eastwick & Harrison is designed to obviate this difficulty, by giving to the eight wheel engine only two bearing points, one on the guide truck, and the other on a frame supported by the driving wheels. The axles of the drivers are placed one in front, and the other behind, the fire box, and are confined between pedestals of the usual form fixed to the main frame of the engine, which allow vertical play, but prevent any horizontal motion.

The bearing pins, instead of abutting against springs fixed to the frame in the ordinary manner, are jointed to the extremities of horizontal beams of cast iron, one of which is placed on each side of the engine.

To the centre of these beams, or levers, are jointed wrought iron rods, which pass down through the engine frame, and carry the springs which support the weight of the engine. The connecting rod of the piston is attached to the hinder wheel, and this communicates motion to the front driver by a coupling rod attached by a ball and socket joint.

It is evident that this arrangement will allow to each driving wheel, an independent vertical motion, with the advantage that the engine will partake of only one half the vertical motion of either wheel, in consequence of being suspended at the centre of the horizontal sustaining beam.

The front drivers are without flanches, in order to avoid any difficulty in turning curves.

The peculiarity in the means of maintaining the fire draft, is an apparatus for equalizing the effect of the exhaust steam in the smoke stack, somewhat similar to Gurney's contrivance.

Instead of exhausting directly into the stack, the exhaust steam enters two copper chests, one connected with each cylinder, and escapes from these into the chimney through a number of small tubes.

With the aid of this contrivance the anthracite fire is kept in a state of intense activity, and generates an abundance of steam without the annoyance and danger arising from the smoke and sparks of a wood fire.

The heat of the anthracite fire has been found so great as to melt down the grate bars of cast iron which were used in the first experiments with this fuel.

Messrs. E. & H. have since substituted grooved wrought iron bars, which are protected from the action of the fire by a coating of clay placed within the grooves.

A trial of one of these engines on the road between Broad street and Peter's Island, was witnessed by several members of the Committee, on the 25th of April last.

It happened, unfortunately, on that occasion, that the business of the road did not furnish so many cars as were desirable for a fair experiment.

The particulars so far as made known to the Committee, were as follows:

Weight of engine, 28,350 lbs.	Weight on drivers, 18,059 lbs.
Cylinders, 12 inches diameter,	Steam, 90 lb. to square inch.
Length of stroke, 18 inches,	Driving wheels, 44 inches diameter.

The train consisted of 32 loaded cars, estimated at 5 tons each, 2 empty cars weighing 9800 lb., and tender, 5 tons, making a total of 169 tons. This train was started with great ease on a rising grade of 27 feet to the mile, and drawn to the foot of the inclined plane, the distance being about 3 miles, partly on a rising grade of 35 feet to the mile, with several short curves, and the road in such bad condition as to keep the sustaining beam in continual vibration.

A few days after this experiment, one member of the Committee had an opportunity of witnessing a more decisive trial of the power of the engine.

On the latter occasion, the train consisted of 34 single cars, estimated at 5 tons each, 4 double cars, 10 tons each; one of Mr. Dougherty's iron boats 50 tons, and the tender, 5 tons; total, 265 tons.

This train was started without difficulty, on the same rising grade of 27 feet to the mile, and drawn over the 35 foot ascending grade and short curves with apparent ease, and with steam blowing off during the whole trip.

This highly interesting experiment was brought to a close somewhat abruptly after proceeding about 2 miles, by the breaking down of one of the cars near the middle of the train.

Although this accident abridged the trial of the power of the engine for draught, it afforded an opportunity of displaying another excellent trait in its performance, this was the facility of reversing* while under way.

As soon as the accident happened, a person stationed on the after part of the train passed a signal to the engineer, the latter immediately reversed the engine and brought the enormous moving mass to a stand before it had run half its own length. The satisfactory character of the experiments

*For a report on this mode of reversing, see Journal of Franklin Institute, vol. xviii., p. 179.

detailed above is sufficient to enable any one who is conversant with transportation on rail roads, to form a correct opinion of the merits of this engine. The impression of those members of the committee who witnessed the trials, is, that it is well adapted for the use of anthracite as fuel, and for very heavy draught; with less tendency to injure the road or to receive injury on a bad road than engines of the usual construction.

By order of the Committee.

WILLIAM HAMILTON, Actuary.

May 9, 1839.

At the request of Messrs. Eastwick & Harrison, the committee insert the following letter from A. Pardee, Jr. Esq., Engineer of the Beaver Meadow Rail Road, in reply to their letter requesting information relative to the construction of the road and the performance of their engines upon it.

COM. PUB.

Hazleton, Pa., June 8th, 1839.

MESSRS. EASTWICK & HARRISON,

Gentlemen—I have received your's requesting information as to the construction, &c. of the roads in this region, on which your eight wheeled locomotives are employed.

The Beaver Meadow Rail Road, where one of those engines has been in use two years, has an iron plate rail of $2\frac{1}{4}$ by $\frac{5}{8}$ inches; the wooden rails or string pieces, are oak, a portion 5×7, the remainder 5×8 inches; where the 5×7 rails are used, the cross ties are placed three feet from centre to centre, where the 5×8 they are four feet. The cross ties are laid on plank mud-sills $2\frac{1}{2}$ inches thick by 10 to 12 inches wide. The shortest curve has a radius of 300 feet; length about 200; but at the foot of the inclined planes, there is a curve, around which the engines now daily pass, the radius of which is 250 feet, the length about 300. The heaviest grade is 96 feet per mile, at two points, about $\frac{3}{4}$ mile each, there is an average grade of 80 feet per mile for 5 miles—on the heaviest grade the shortest curve is 550 feet radius, the length about 400 feet. The Hazleton Rail Road, on which two of your eight wheel engines are now in use, has a plate rail $2\frac{1}{4}$ by $\frac{5}{8}$ inches, the string pieces are yellow pine 5×9 inches, the cross ties 4 feet apart, from centre to centre, the mud-sills $2\frac{1}{2}$ by 10 to 12 inches. The heaviest grade is 140 feet per mile for $1\frac{1}{2}$ miles; this part of the road was not intended, when made, for the use of locomotive power, but it was found in practice that by doubling our trips we could use the engines with more economy than horse power. In regard to the effect on the road, so far as my experience goes, and I have seen the two classes of engines in daily use for more than two years, I would say that the eight wheel engine was easier on the road than a six wheel engine of the ordinary construction, with the same weight on the two driving wheels as on each pair of the driving wheels of the eight wheeled.

There are now in use on the Beaver Meadow and Hazleton Rail Roads, seven locomotive engines with horizontal tubular boilers, in which anthracite coal is exclusively used as a fuel after the first fire in the morning, and that we continue to use it when we can have wood for the cost of cutting, is sufficient evidence that we find it to our advantage. We have the Hercules at work, and so far, she performs well, running around the curves with great ease. Respectfully yours,

A. PARDEE, JR.

Mechanics' Register.

LIST OF AMERICAN PATENTS WHICH ISSUED IN JUNE, 1838,
With Remarks and Exemplifications by the Editor.

219. For improvements in the *Net for catching Mackerel* and other fish at sea, or in deep water; Benjamin W. Hale, Newbury, Essex county, Massachusetts, June 4.

This, as the title indicates, is a patent taken for constructing a net to be used at sea. The manner of fixing the floats and attaching the lines so as to adapt this net to the designed purpose, are shown in the drawing, and explained in the specification; and the claim is necessarily founded upon, and limited to, these particular devices.

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220. For an improvement in *Gas burners;* Antoine Arnoux, city of New York, June 4.

The claim under this patent is to the "increasing the length of the socket, and giving it a conical form at the top; and the placing over it a cover." The patentee remarks that "The intensity of the flame of a gas light depends upon the shape and dimensions of the flame, the disposition of the burner, and the relation of the flame to the air," and believes that he has by increasing the length of the socket, and by making the top conical, taken advantage of these principles. The particulars of form would require to be shown by a drawing.

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221. For an improved mode of *Making and Stretching the Sackings of Bedsteads;* William S. Anderson, Shelbyville, Tenn., June 4.

Like many other *improvements* which are made the subject of patents, the main novelty in the foregoing consists in attaining the end proposed in a way less convenient and useful than had been previously known and practised. In the present instance, the sacking is to be in two widths, the side and foot rails of the bedstead are to be round, and the sacking is to have a wide hem at one side and end, forming a space for the side and foot rails to pass through. The two parts are to be corded up the middle. The sacking is to be strained endwise by being attached to a cross rail or stretcher, towards the head. A screw passes through the centre of the head rail, and into the cross rail or stretcher, and by turning this screw the sacking is to be tightened; the screw is represented in the drawing as made of wood, and the whole device is rather *wooden.* Rails tightened by screws passing through a head rail have in England been nearly as common as bedsteads, for at least a century past, and thousands of them have been brought to this country. The sacking did not, it is true, embrace the rails, and so far, the thing may be new, but we think the utility of this part will be confined to the bed bugs, who will find in it a "snug harbour." The claim is to "the sacking made, fastened, and stretched, substantially, as herein described, in combination with the stretcher, as herein described."

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222. For a Machine for *Cutting Straw, Hay, Turnips, &c.;* Ebenezer Dewey, Butternuts, Otsego county, New York, June 4.

The claim made is to the manner of adjusting the bed knife, which is an adjustment scarcely worth describing; the patentee, however, has occupied a

arge number of pages with the description of *his* straw cutter, which is one of the most common kind, consisting of a trough for containing the straw to be fed towards one end, and there cut. In the office, the mode of adjustment was of course considered as containing something new, or the patent would not have been granted.

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223. For Manufacturing a *White Pigment to be used as a substitute for white lead;* William Cumberland, city of New York, June 7. (See Specification.)

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224. For a *Machine for Shaving Shingles;* William Thorn and James Thorn, Jr., Plainfield, Essex county, New Jersey, June 7.

The shingle to be shaved is placed upon a table, and passed in between revolving, feeding rollers, which conduct it to a revolving cutting cylinder, carrying knives which extend across the shingle. The bearings of this cutter cylinder are in slides which are made to rise vertically by means of an eccentric, for the purpose of giving the proper taper to the shingle. As it leaves these cutters, the edges are dressed by knives on vertical, revolving shafts, which complete the operation.

"The invention claimed consists in the combination and arrangement of the parts for giving the horizontal cylinder of cutters a simultaneous vertical motion, as the shingle is drawn between the rollers, by which it is made to receive its proper taper, in the manner described; also the combination and arrangement of parts for jointing shingles of different widths, as described." The latter claim relates to the means of bringing one of the jointing cutters up against the side of a shingle, so as to operate upon it whatever may be its width.

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225. For a *Washing Machine;* Robert W. Olephant, North Granville, Washington county, New York, June 7.

A trough is made to contain the suds and the clothes to be washed; this trough may be three feet six inches long, and fourteen inches wide, the sides flaring out; it may be twelve inches deep at one end, and fifteen at the other, the bottom forming an inclined plane. A beater, with handles, is to be worked backward and forward in the trough, by hand; this beater rests on friction rollers on the bottom; and friction rollers may also be placed for the handles to bear on; the descent of this part also facilitates the operation. The beater being worked by hand, it is remarked, always accommodates itself to the quantity of clothes. The claim is to "the combination of the beater, moved by hand, with the respective rollers and the inclined bottom of the trough, constructed and operating as set forth.

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226. For *Forcing and Raising Water* by the aid of a triple sliding valve; Elisha Vance, Wilmington, Clinton county, Ohio, June 7.

The patentee says that his "invention consists in a triple sliding valve, which receives and discharges the fluid alternately into a box, or double cylinder;" and this he claims. It is much more easy to alter than it is to improve the valves of pumps, the best valves we mean, and we are well convinced that in the present instance no useful advance has been made; the affair is somewhat intricate, and we shall not attempt to describe it; but for the guidance of those who may be seeking improvements, we will observe that the perfection of a valve depends upon its giving, when open, an

ample passage to the water without wiredrawing it; upon its opening to a short distance only, and closing rapidly; and upon its changing the rectilenial direction of the water as little as possible.

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227. For a *Portable Saw Mill;* Pearson Crosby, Fredonia, Chatauque county, New York, June 7.

In this machine the saw used is a straight one, strained in a frame in the ordinary manner, excepting that there is a change of form in the straining apparatus. As it is proposed to use a thin saw, guides are constructed to prevent its deviation; there are also a number of friction wheels, and several devices of a peculiar character, which are intended to be embraced in the claims to "the arrangement of the stocks and rollers for keeping the saw true, in combination with the reciprocating saw-gate; and the combination and arrangement of the levers, rods, spring, screw, and dog, for feeding and regulating the feed as described."

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228. For an improvement in *Lamps;* Samuel Rust, city of New York, June 7.

Mr. Rust is the patentee of several improvements in the common house lamp. His lamps have flat wicks, which are usually raised by a toothed roller turning within the tube of the burner. The patent above named was taken for an improvement upon this plan by substituting a thin wheel toothed on its edges, for the roller; this wheel may be from three eighths of an inch to half an inch in diameter, and its toothed edges are brought into contact with the wick by cutting a slit through the burner and stopple which will admit it to enter; the wheel revolves on a pin attached to the tube, and may be turned by touching it with the finger, a pin, or other article.

We believe that this improvement, so called, has not gone into use, as we see Mr. Rust's lamp in extensive use with the original revolving cylinder, which operates so well as scarcely to leave any thing to be desired.

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229. For an improvement in the *Rake for Raking Wheat, Rye, &c.;* Daniel Smith, Vincennes, Indiana, June 7.

The rake described is said to be "For raking wheat, rye, oats, barley, peas, without cutting. Rice, buckwheat, flax, and hemp, if rotted in meadows, and many other articles, without rubbing out the grain, or rubbing off the lint or leaves." The patentee gives special directions to the carpenter how to lay off, and make the rake; and to the operator respecting the mode of using it; the description and claim do not occupy much space, the latter being to "the method of arresting the revolution of the rake, and the springs, or runners, attached to the teeth, upon which the rake slides." The rake itself, is like such horse rakes as have been long in use, which are allowed to turn over and deposit the material raked, and by this revolution to present another set of teeth to operate as before; the device claimed as new in this part is the manner of disengaging the handle by which the rake is guided and managed, and of replacing it on the opposite side. The rake is sometimes to have one row of teeth only, in which case it is tilted up to discharge its load. The springs, or runners, are merely pieces which are to run upon the ground, and raise the teeth to a small height therefrom.

230. For an improved mode of manufacturing *Flying Shears for the purpose of Shearing Woolen Cloth;* Seth Parsons, Hoosack Falls, Renssalaer county, New York, June 7.

The tool, or instrument, which forms the subject of this patent, is for bending the plate of steel, or rather of iron laid with steel, which is to stand spirally round a shaft, in such manner as that it may be perfectly, and almost instantaneously, formed, when heated. The blade is not only to be bent into the spiral form, but it is also to be bent at right angles longitudinally, so as to form a flanch by which it can be screwed to the cylinder, and be removed with perfect facility. A shaft is formed of the same diameter with that to which the blades are to be attached, and this is surrounded by a spiral wing, having the curvature to be given to the shear plates. The plate is to be first bent at right angles longitudinally, it is then heated, and applied against the spiral wing, where it is held by a suitable device; this part of the instrument is on a carriage running on ways, and by drawing it forward, rollers properly formed and placed, bear against the plate, and give it the right set. The claim is to the manner of constructing the machine so that by "the combined action of the rollers and winged shaft, in the way described, the flying shear receives the exact form and set necessary to its being affixed to the shaft."

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231. For an improved *Variety Couch;* Eleazer Carver, Bridgewater, Massachusetts, June 12.

The claim to this couch would not afford any idea of the particular manner of forming it, nor would an examination of the thing itself present much of novelty to any one acquainted with the numerous articles of the kind which have been contrived. Said couch, or easy chair, may be suspended, so that its occupant may be swung within it; the inclination of the back, and other parts, may be varied, by means of notched segments, bolts, thumb screws, &c. &c. The patentee is limited to his own particular arrangement, and it would be a folly to attempt to violate his rights.

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232. For an improved *Windlass;* Frederick G. Cameron, city of New York, June 12.

The gearing of windlasses has undergone numerous modifications for the purpose of increasing, or regulating, the power according to the resistance to be overcome; and every machinist knows that this may be accomplished by modes capable of indefinite variations. There is no difficulty in the thing, but much merit in devising new modes which shall excel those in use, in simplicity, stability, or convenience. We cannot describe the manner of carrying the thing out in the case before us, but it appears to be good, and may probably be found to possess the desired qualities.

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233. For an improvement in the manner of *Forming the Ribs of Saw Gins,* for ginning cotton; Eleazer Carver, Bridgewater, Plymouth county, Massachusetts, June 12.

The claims under this patent will afford a tolerably clear idea of the nature of the improvement; they are to the giving of a ridge form to the upper surfaces of the ribs, to give an inclination of the seeds towards the saws, and prevent the breaking of the fibre by the obtuseness of the angle against which they are forced; to the giving a larger space for the filling the saw teeth with cotton; to a slope given to the ribs where the cotton is drawn in,

thereby increasing it in width, and allowing the seeds to escape, to prevent it from being choked.

234. For a *Machine for Shelling Corn;* Thomas Wright, New Village, Warren county, New Jersey, June 12.

This corn sheller operates like the common bark mill with a conical nut turning within a shell, or case, the axis of the nut being vertical. The nut is set with pins for shelling the corn; and the case within which it turns is formed of staves, or slats, denominated springs, as they are made thin enough to be elastic; these are connected together by a ring at their upper ends, but having play at their lower ends; they are surrounded by a hoop, furnished with check screws, to regulate the distance to which they may spring; there are spaces between the staves sufficiently wide to admit the passage of a grain of corn. The claim is "to the construction and arrangement of the springs forming the concave around the frustrum of a cone, in combination, as above described, with the large ring and screws for confining them in a circle, and at the same time allowing the lower, or larger, ends of them to recede from the centre when large ears of corn are admitted, and to advance towards it again when small ears are admitted."

The corn is to be put into a feeding hopper of the usual form, but we do not find any thing to cause it to enter the machine endwise, without which the cob must necessarily be much broken up.

235. For a *Planing Machine;* Robert Luscombe, Benton, Yates county, New York, June 12.

This machine has its irons for planing fixed at the ends of the arms of a wheel revolving horizontally, below which the stuff to be planed is made to advance as in some other machines. There is, in fact, a number of the same class, and the patentee has confined his claim to "the application of springs to the face of the planing wheel, in the manner substantially as described." These springs are to bear upon the stuff, and the patentee states their use to be "first, to steady the motion and prevent any vibration of the wheel while in operation; and secondly, to give the face of the springs, or planing wheel, a constant bearing on the stuff being planed, and keep it on a level with the cutting edge of the plane irons, as the irons wear away by use."

236. For *Bedstead Fastenings;* Pardon Post, New Haven, Connecticut, June 12.

These fastenings differ somewhat in form from some that have been long used, or rather which were used many years ago, for the same purpose, but they are the same in their mode of action. A cast iron plate is to be fastened on the ends of the rails, these plates having dove-tailed, or wedge-formed, projections on them, which fall into recesses in corresponding plates screwed to the posts. The claim is to "the addition of a plate having two dove-tailed tenons fitting into the lower part of another plate; the whole being constructed substantially as described."

237. For improvements in the *Flyer for Spinning Cotton, &c.;* Richard E. Yerkes, city of Philadelphia, June 12.

The difference between this apparatus and some before in use is not of

that striking character as to be pointed out without the drawings and references; the claim, therefore, if given, would not afford this information.

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238. For an improved *Sliding Sofa Bedstead;* George Wode, city of New York, June 12.

Pieces of furniture of this description have been modified in a hundred forms, and were their history written, its readers would be few in number; in the case before us, the patentee claims "the combination of a hinged front with a hinged frame; a windlass and endless screw for tightening the sacking bottom with the sliding rails," and various other matters and things, that to be understood, must be seen. The thing is neat and commodious.

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239. For an improvement in the *Door Lock;* Turner Whitehouse, Boston, Massachusetts, June 14.

There is not much of novelty in this lock, and the claim is in consequence principally confined to some unimportant peculiarities; it is to the application of spiral springs acting on the dog and arm in returning the latch bolt to their original positions; and to the post for securing the lock works in their respective places; and also to the arm as combined with the spiral spring, latch, and lock bolt."

Various friction rollers are to be used to cause the lock to work easily; the key is to turn against friction rollers on the bolt, and on the tumbler, which we are very apprehensive will prove to be troublesome appendages when the oil hardens, and the lock becomes foul.

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240. For an improvement in constructing the *Flues of open Fire-places;* Thomas Whitson, city of New York, June 14.

This fire place is constructed with a frieze supported by two columns; the frieze is hollow and divided into two parts by a longitudinal partition; the columns also have a partition within them, dividing them into two flues, an ascending and descending. The patentee says that the nature of his improvement consists in carrying the smoke from the grate into the front part of the frieze, down the front part of the columns, and up the back part of the same to the rear of the frieze, and thence into the chimney. The claim is to "the partition above described, of the top, or frieze, and of the columns."

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241. For a *Progressive Pile Driving and Grading Machine;* Smith Cram, city of New York, June 14.

This apparatus is intended for driving piles for the foundation of railroads, in passing over valleys, or in other situations requiring a provision of this kind. The pile machine is like those ordinarily used, but it is placed upon a carriage, which is to advance as the work progresses. The piles are to be sawed off at any required grade by means of a circular saw, duly regulated. The claim is to "the combination of the power of driving the two rows of piles, with that of the grading saw; together with the scarfed shifting rails and cross ties by which the machine can be moved forward on the foundation, placed, and graded, in the prosecution of its purpose," &c. &c. We do not think it necessary to give the whole claim, as the foregoing will afford a good general idea of the construction and operation of the machine, and more than this would require drawings.

242. For an improvement in the mode of *Constructing and using Writing Desks;* Seth Luther, Boston, Massachusetts, June 19.

Claim. "What I claim as my invention, and desire to secure by letters patent, is the making the desk slide up and down on the stand, and the mode of working it up and down, in combination, as herein described; I also claim the herein described mode of changing the position of the leaves of the desk."

The foregoing points out the principal object of this patent, namely, the raising or lowering of the body of a desk upon its legs, or stand, which is to be effected by a rack and pinion, the latter being turned by a winch. The description given is very elaborate, although the thing is in itself of no very intricate nature. The "changing the position of the leaves" refers to the mode of altering their slope, or of causing them to stand horizontally. In the devices employed there is not any thing of novelty, they being such as are well known to every machinist, and the same ends might be attained by other modes, and not interfering with those claimed.

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243. For *Locks for the Doors of Banks, Vaults, &c.;* James McClory, city of New York, June 19.

This is a combination lock, the construction of which is not to be explained in words; it manifests much skill in its arrangements, and it has the merit of not depending upon the particular key fitted to it, as, should this be lost, another can be made without the necessity of interfering with the lock.

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244. For *Spiral Springs* for, and the mode of applying them to, Carriages; Remember Baker, Elba, Genessee county, New York, June 19.

These springs are to be made of a flat strip of steel, which is to be wound so as to form a conical spiral; a correct idea of this form would be given by taking a common watch spring, and drawing up its centre coil, until three fourths of the width of each coil was raised above the next outer coil. The force is to be exerted upon this spring by pressing upon its centre, so as to depress the coils and cause them to enter further one within the other.

These springs may be placed directly under a carriage, or wagon, body, one at each corner, and resting upon, or fastening the same to, the bolsters, by means of bolts.

It is proposed to attach the springs to carriages through the intervention of vibrating levers; and a claim is made to "the invention of the spiral conical spring made of flat plates of steel, and the manner of using the same by means of levers, as described."

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245. For a machine for *Sawing and Jointing Staves;* Nathaniel Moore, Ellsworth, Hancock county, Maine, June 19.

Patents have been obtained for sawing staves by means of a concavo-convex, or, as the workmen denominate it, a dishing, saw; but to this no valid claim can be made, as a premium was awarded by the Society of Arts in England for a saw of this description, as long ago as the year 1805. The staves are to be sawed by a saw of this description in the machine which is the subject of this patent, and the improvements claimed are to devices connected with the manner of moving the carriage, of throwing it in and out of gear, of setting the stuff, and of jointing the staves after they have

been sawed; these devices are exhibited by the aid of a number of figures in the drawings; the jointing is to be effected by revolving knives, placed around a vertical cylinder; several staves, after being sawed, are to be placed upon each other upon a suitable carriage, and being brought up against the cutters, are jointed at one operation.

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246. For a *Wrest Pin for Piano Fortes;* Daniel Walker, city of New York, June 19.

Instead of the wrest, or turning, pin, generally used in piano fortes, a screw is to be used to move a nut which has the string attached to it. In the block which receives the turning pins, standards are to be inserted which rise vertically from the block to the height of about two inches. A screw with a square head is to pass through a projecting piece on the upper end of the standard, its point resting on a metallic stop. This screw passes through a sliding nut, one edge of which is guided up and down by a groove in the standard, and to this nut the wire is attached. At the lower end of this standard there is a small pulley, around the lower side of which the wire passes, extending from it along the instrument. The claim is to "the application of the nut, screw, and pulley, as above described, as a substitute for the ordinary turning pin."

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247. For an improvement in the *Plough Clevis;* Aaron Carman, Columbus, New Jersey, June 20.

This clevis may probably have its merits, but we cannot make them known without devoting more space to the matter than we can conveniently afford; we should not aid in the understanding of its construction were we to insert the claims.

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248. For a *Cooking Stove*; S. J. & J. S. Gold, city of New York, June 20.

This stove the patentees denominate the "perfect coal cooking stove," but perfect as they esteem it, there can be no doubt that it will be followed by others which will be pluperfect. After describing the stove at great length, the manner of its operation is thus stated:

"Keeping the ash pit close in front, the draught of the stove causes the air first to enter the hot chamber through the open work of the door; it then passes the sides of the furnace and the air heaters, next it passes each side of the prism, and under the oven plate, into the oven; then reaching the back of the oven in the circular part, it enters through the sink in the inclined plate to the ash pit, and is ready to enter the fire through the grate, having passed this circuit instead of entering directly to the fire by the front of the ash pit in the ordinary way."

What is called "the hot chamber," is a space surrounding the iron cylinder which contains the fuel.

"What we claim as our invention is, first, the mode of heating the oven by hot air. Many have heated their ovens by hot air, more or less, but none have ever applied the hot air on the principle above described, to wit: first to the oven and then to the support of combustion. Secondly, we claim the air heaters upon the principle described. Thirdly, we claim the grate upon the principle described, when the bars are circular laterally."

By the bars being "circular laterally," is meant the giving a lateral

curvature to the grate bars, to take off the strain, and tendency to break, from their expansion by heat.

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249. For a *Spark Catcher*; T. L. Smith & W. J. Van Lone, Newark, New Jersey, June 20.

In this, as in most of the spark arresters, there will be a very considerable obstruction to the draught, which is a fatal objection. When the heated air and sparks arrive at the upper end of the chimney, they are to be turned downwards by a curved cap, with a view to the causing of the sparks to fall, by their own gravity, into a compartment prepared for them; the mode of carrying this intention into effect differs in this apparatus from that followed in others, but not to an extent, or in a manner, which appears to us likely to render it efficient.

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250. For a *Machine for Thrashing Clover Seed;* William B. Davis, Reading, Perry county, Ohio, June 20.

A revolving rubber, set with teeth, and made in the form of a frustrum of a cone, is placed within a corresponding concave, also set with teeth. The axis of this conical body stands horizontally, and the clover is fed through a hopper at the top of the huller.

The claim is to "the so arranging of the teeth on the frustrum of a cone, or runner, as to cause the chaff and seed to be discharged at the base of the frustrum, by which the heads of clover are retained a longer time in the machine, subject to the action of the teeth; all constructed and arranged substantially as set forth."

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251. For an improvement in the mode of *Constructing and Managing Vats for Tanning Leather*; Wm. & J. C. Rouse, & S. Taylor, Bedford county, Virginia, June 20.

The system of vats which form the subject of this patent are to operate upon a principle which has been before essayed and approved; that of establishing a communication through the system by means of hollow trunks, allowing the ooze to be transferred from one vat to another. The variation in the manner of carrying out this principle adopted by the patentees, has been deemed sufficiently original to be made the foundation of a patent. The bark is to be contained in a movable reservoir, or box, perforated to admit the fluid, and capable of being raised by a windlass and transferred from one vat to another.

The claims are to "the manner of arranging the aqueduct, or tubes, at or near the lower parts of the vats, in combination with those at a greater elevation, but in no case approaching the upper portion of the vats, so that the ooze may be transferred from one to the other, substantially in the manner set forth. Also the manner of connecting the lay-away vats with the first series, as set forth, so that the strong liquor may, at pleasure, be conveyed into them, in the manner set forth. We likewise claim the movable reservoir, or vat, for containing the bark."

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253. For an improvement in the *Spring Window Fastener*, for window sashes; Jonathan Bacon, Bedford, Middlesex county, Massachusetts, June 20.

This is a contrivance differing so little from other such fastenings, as not to merit any particular description. It is merely a spring latch which is to

catch into the side of the sash frame, and hold it there; it is as good, undoubtedly, as many of its predecessors, but no better. A question is often put, why does the office grant patents for things so trifling? The reply to this is, that the office is governed almost entirely by the fact of there being *some* novelty in the thing proposed to be patented; applicants are urgent, and have always, in idea, a great fortune depending upon the seal of the patent office; and if the hand cannot be placed upon something identical with the thing sought to be patented, it becomes necessary to grant it; were this not done, two or three individual applicants would consume the whole time of the office with their special pleadings on behalf of their bantlings. There is a *necessity* in such cases, of which no one, out of the office, can form a correct estimate.

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253. For a *Machine for cutting Screws on the ends of Bedstead Rails*; Jacob Lindley, Cynthiana, Harrison county, Kentucky, June 20.

The object of this machine is to cut screws on the ends of bedstead rails, and in the posts, in such manner as that a right and left handed screw at the opposite ends of a rail should enter and come to a shoulder at the same time, and in the proper place. There are but few wood turners and bedstead makers who would find any difficulty in constructing such a machine without inquiring into how the thing had been done before; and there are many who would think the labour misspent in the production of an instrument for the purpose, deeming the proposed mode of fastening bedsteads together very inferior to most others, and having, therefore, little or nothing to recommend it. The claim made by the patentee is to the particular manner in which he has arranged his apparatus.

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254. For a *Fire and Water Proof Travelling Trunk*; Charles F. Miller, Lancaster, Pennsylvania, June 20.

The claim will show the general construction of this trunk, this being to "the manufacturing of chests and trunks of double bodies of sheet iron, and filling the space between these two, with the within named composition, or with any other possessing analogous properties, in the manner described."

"The within named composition" consi sts of "equal quantitiesof pulverized chalk, and curd of thick milk, bones of animals burned and pulverized, then boiled in urine until the quantity is lessened one-third. The best kind of asbestos pulverized. Let the proportions be about one-sixth of the first, two sixths of the next, and three of the third; to these add whites of eggs and blood sufficient to make it into a paste of a proper consistence, and apply it as directed."

To animadvert on the nature and merits of this composition, would be an entire sacrifice of time; a thousand others, equally good, could be produced, and we much doubt whether the doctor takes his own medicine. The idea of rendering a *travelling trunk fire proof*, by interposing a bad conductor of heat between thin plates of sheet iron, is altogether absurd; the difficulty of making fire proof chests is well known, and those made would not suit many travellers. Any trunk may be made more perfectly *water proof* by lining it with sheet tin, soldered at the joints, than can be done by the plan proposed.

We have been informed that the patentee has sold many of his trunks, which is well enough for him; and for the good of the purchasers, we most

truly hope that they may never be put to the ordeal by fire, as they will stand but little chance of escaping unscathed.

255. For *Preventing Canker Worms, &c. from ascending Trees*; Jonathan Dennis, jr., Portsmouth, Newport county, Rhode Island, June 20.

"What I claim as my invention, and desire to secure by letters patent, is a circular metallic trough and roof, made of one piece of metal, and bent to conform to the shape of the tree; using for the purpose any metal that can be bent into the proper shape." Such is the claim; and the trough and its roof, it is stated, may be made to stand about an inch from the tree, this space being filled by caulking with waste cotton, or other suitable material. The trough is to contain some fluid destructive of the worms, and the roof to prevent articles from falling into the trough. The apparatus is to be supported by nails or plugs driven into the tree.

We are not told how the metallic trough is to be joined so as to form a continuous circle around the tree, and although this may be effected without instructions from the patentee, it will never, or rarely, be done, excepting he can prescribe an easy mode of doing it; and we will undertake to prophecy that should he even do this, the trees furnished with his protectors will still be few and far between.

256. For *Preserving Vegetable Substances from Decay*; John Howard Kyan, Great Britain, June 23.

This patent is for the well known process denominated the Kyanizing process, and applied principally to the preservation of timber. It consists in soaking the material to be preserved in a solution of corrosive sublimate in water, a pound of the salt to five gallons of water. The protective effect of this process has been established by the experience of several years, it having been the subject of a patent in England long prior to the issuing a patent here, which was done by special act of Congress. That body, we suppose, had sufficient reasons for granting this patent, but we have never heard, and have been unable to divine, what those reasons were. The process was well known here, and we had nothing to learn respecting it; every man in the United States had a right to use it, and this right had existed for several years, but it is now abrogated, and, it seems to us, without any equivalent. Let any American apply to the Parliament of Great Britain for an act in his favour under like circumstances, and we are well assured that he would apply in vain. National comity, therefore, did not call for the act; but we must be suffering under obtuseness of mental vision, for we may not doubt the wisdom of Congress. This act opens the door for special legislation, and there are hundreds in Great Britain who may, with equal propriety, we think, knock at the same door.

257. For a *Machine for Filing Hand Saws*; James S. Harris, Poultney, Rutland county, Vermont, June 23.

The saw is to be embraced in a clamp, and above this there is to be a square frame to which the file is to be affixed by suitable screws, or other contrivances, attaching it to the two ends of the frame, in the proper position. This frame is to be placed across the clamp containing the saw, the frame running upon shifting ways, corresponding with the angle to which the teeth are to be filed. The details we do not think it worth while to

give, and of the machine itself we are not disposed to speak with much favour; no good workman will use it, and it will be but a poor crutch for a lame one. For this opinion we could furnish many substantial reasons, but they will occur to others capable of judging on such a subject.

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258. For an improved *Horse Power*, for driving machinery; Miles T. Mix, Danby, Tompkins county, New York, June 23.

In this horse power, the animal is to draw round, by means of a lever, or sweep, there being a centre wheel with teeth on the inner rim, which gear into four pinions, in a manner analogous to that adopted in several other machines. The particular variations, and additions, devised and adopted by the present patentee, cannot be clearly described in words; we therefore pass it over with this brief notice.

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259. For an improvement in the *Smith's Forge*; Amos Binney, Point Pleasant, Bucks county, Pennsylvania, June 23.

A cast iron box is to be built into the hearth of the forge. The upper side of the box is to be a few inches below the surface of the hearth, and is to be covered by grate bars. The bottom of the box is made to slide, and it can therefore be withdrawn; through one side of this box there is a hole for the introduction of the wind from the bellows. The coal is, of course, to stand upon the grate, and the forge is, in general, to be used in the ordinary way; but when it is desired to keep up a glowing fire without the blast from the bellows, the sliding bottom is withdrawn, and a natural draught of air admitted to the fire; a hood of sheet iron is then placed above the coals, to increase the draught.

The patentee says: "I do not claim the constructing of a cast iron or other box covered by a grate, and receiving the blast through an opening below said grate, this having been before used." He then claims the combining of the sliding bottom with such a box and grate, for keeping up a continuous fire, with the aid of the hood, as described.

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260. For an improvement in the *Hearth of Blast Furnaces*; George Poe, Elkridge Landing, Anne Arundel county, Maryland, June 23.

"The nature and object of my invention consists in conveying the melted iron into a reservoir placed on the outside of the furnace hearth, by means of a channel cut entirely out of the bottom stone, the object of which is to leave the iron in such a situation as to be accessible at all times for casting without interfering with the operation of the furnace. This channel may be differently formed, and the reservoirs be differently situated about the furnace hearth, as may best suit the purposes for which the invention is intended."

After the foregoing, the patentee describes and represents the particular manner of procedure which he has adopted, and claims the invention, generally, as above described.

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261. For improvements in the "*Furnace for Refining Iron*;" James Sharp, Liverpool, York county, Pennsylvania, June 23.

The claim will convey a good general idea of the nature of this invention; it is as follows: "I claim the constructing of the arch near the throat of the chimney to receive the pig iron for a bloom, to be heated by the escape heat

whilst the bloom is being melted in the chamber of combustion, as described."

262. For improvements in *Stoves and Fire-places*; Joseph Hard, Stoneham, Middlesex county, Massachusetts, June 23.

"The general features of my improvement consist in such an arrangement of the oven, boiling apparatus, fire-place, and flues, that the operations of boiling, baking, and steaming, may be carried on at one and the same time by the same fire, or separately whenever occasion may require." The mode of effecting this is then described, and the following claims made:

"The combination of the tubular oven with the boiling and steaming apparatus, and fire-place, arranged and acting together as described; and separately, an oven constructed with tubular flues, passing through the same from bottom to top, and so situated that the smoke and heated air from the furnace shall pass through the same on both sides, and impart heat to the interior of the oven."

263. For a *Machine for Cutting Straw and other Fodder*; Samuel Gibson, Arcadia, Wayne county, New York, June 27.

It will be seen by the claim that there is but little of novelty in the so-called improvement; and it may, indeed, be fairly doubted whether there is any of this ingredient, as hundreds of persons may have thought and acted upon the introduction of an additional wheel in the gearing, without sending their thoughts to the patent office. The claim is to the applying the intermediate gear wheel on a movable stand, so as to admit different sized pinions for driving the feed rollers, and thereby changing the feed, in combination with the feed rollers, and the rotary cutters."

264. For an improvement in the *Self Acting Mule*, for spinning cotton and other fibrous substances; James Smith, Great Britain, June 30.

This patent was granted under a special act of Congress, the machine having been patented in England in August, 1834. The specification, with a plate, was published in Newton's Journal, vol. v. p. 193, Conjoined Series. Various attempts had been made to construct such a machine in the United States, from the published description, but without success; and such was deemed the value of the invention that it was found impossible to procure a machine, the inventor and the manufacturers being interested in preventing it. A purchase of the right for the United States was, however, effected by the Mattawan Company of New York, and under these circumstances the special act was granted, and that, as it appears to us, with very good reason. The machines are now manufactured by the above company, and are going into extensive use. For a description, we refer to the work above named.

265. For an improved mode of *Changing the Poles of Electro-Magnets*; Nelson Walkley, Tuscaloosa, Alabama, June 27.

It has now become almost certain that the attempts to obtain motion with power sufficient to render it available in the driving of machinery, by electro-magnetism, cannot be successful, from causes inherent in the principle whose aid is invoked; and that if it is ever obtained, it must be the result of discoveries which will lead the experimenter into a new channel. We

shall not, therefore, undertake to describe the particular mode adopted by the patentee in the construction of his pole changer.

266. For an improvement in the *Machine for ascertaining the weight of cargoes contained in Canal and other Boats;* Amory Awsden, Rochester, Monroe county, New York, June 7.

The claim is to "the construction of the tube, or stem, receiving the water through the small aperture at the bottom, and gradually enlarging until it connects with the cylinder, thereby preventing a sudden rise or fall of water within, and protecting the gauge from being disturbed by any sudden motion of the boat, or vessel, or agitation of water without, which is highly important when determining the weight of the cargo, and also in requiring so small a hole through the bottom of the vessel as to produce no injury whatever."

The whole device consists in a float like the bulb of an hydrometer, having a stem which operates as a gauge, or index, the water being admitted through a small opening into the tube within which the float operates.

267. For a mortise latch for doors; Leonard Foster, Boston, Massachusetts, June 27.

A main object in the construction of this latch is to keep it flush with the edge of the door, in which a notch is made for the admission of the catch, which is driven into the door frame in the direction of the plane of the door when closed. The claim is to the "manner described of inserting a latch, consisting of a simple plate of metal, in a mortise made in the rail of the door; said latch being flush at its fore end with the said rail, and being received by a catch driven into the door frame in the direction of the plane of the door when closed. I also claim the attaching of a small lock to the latch in the manner and for the purpose described." The lock alluded to is to shoot out a small bolt which is to pass under the catch of the latch, which, as the lock is attached to said latch, will effectually prevent its being lifted.

268. For an improved *Press;* George C. Chesley, Rocky Mount, Franklin county, Virginia, June 27.

The patentee says that his press is "to operate by a combination of lever power in the common lever in length and strength, and the power of the screw and wedge," in which announcement there appears to be some obfuscation. As represented in the drawing, a lever placed horizontally, is to be drawn down by means of a windlass, turned by a winch; this lever, and others to which it is attached, are to produce pressure upon any kind of article requiring it; their particular arrangement we shall not stop to describe, because it would take more time than we can now spare, and it would be spent upon an object which does not appear to possess any special claims on the score of its own merits.

269. For *Stoves and Grates for burning Coal;* Eli C. Robinson, Troy, New York, June 30.

The claim is to "the manner of constructing the grate in combination with the apparatus for agitating and emptying it. And the particular manner of heating the passage for the draughts in each end of the top plate

directly over the diving flues, in combination with the flues operating as described."

The grate is divided into three parts, each of which is hung upon gudgeons, which gudgeons pass through the stove plate, and are geared together by three toothed wheels, one of which being vibrated by a handle, the whole will be agitated; and they may by the same means be emptied simultaneously.

There are up and down flues on each side of the fire chamber, with a view to the diffusion of heat.

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270. For an improvement in the art of *Increasing the strength of wrought iron and steel;* Walter R. Johnson, city of Philadelphia, June 30.

(See Specification.)

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271. For an improved *Cooking Stove for Summer;* Anson Atwood, city of Troy, New York, June 30.

A small furnace is made to contain the fuel, over which a kettle may be placed; the furnace may be cylindrical, and is surrounded by a heated air chamber, which communicates with the oven; in its rear is a square oven, through the middle of which a flue leads from the furnace, which flue is in the shape of a hollow shelf, an inch or two narrower than the oven; at its rear end this flue turns up vertically; the body of the oven may be of sheet tin, to prevent radiation. The claim is to "the manner of carrying the flattened flue through the oven, as above described, in combination with the further provision for supplying heat to the oven by the mode of connecting the space surrounding the furnace with the oven, as set forth."

We have a stove of this description; it however has not been fully essayed, not having been received at the proper season, but our full impression is that we shall report favourably of its doings.

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272. For an improvement in *Stoves;* Phineas Gillet, New Hartford, Connecticut, June 30.

The claim is to "the manner of constructing the movable oven, and of managing and heating it, for the purpose of baking or cooking, in a cavity extending from the top to the bottom of the stove." This movable oven is like a large boiler, and it is received in the same manner in a cavity at the back of the furnace, where ovens are ordinarily situated; the draught of heated air from the fire passes around and under it in its way to the escape pipe.

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273. For an improved *Cooking Stove;* Jefferson Cross, Eaton, Madison county, New York, June 30.

This stove has what is known under the name of an elevated oven, which stands at the height of fourteen inches, or more, above the stove. It consists of a double horizontal cylinder, into the space between which flues lead from the furnace of the stove. A pipe leads also from the upper part of this oven into the escape pipe of the stove. The following is the claim.

"The having means to alternately shift the heat from and to the oven, as occasion may require, which is done by adding and extending the flue so far back of the oven as to have sufficient room for the principal pipe without interfering with the oven; and by adding valves, or dampers, under

each of the columns, and under the principal pipe, or at any other given points, which will answer the same purpose, as above described."

274. For an improvement in the *Cheese Press;* Luke Hale, Hollis, Hillsborough county, New Hampshire, June 30.

A press has been in use in the eastern states, which is known under the name of the "Quaker Press," for pressing cheese, in which the weight of the cheese itself produces the required effect, through the intervention of combined levers. The press, which is the subject of the present patent, is a modification of the Quaker press, which would require a plate to make it clearly known.

275. For an improved mode of *Heating the blast in Furnaces;* Charles C. Alger, Stockbridge, Berkshire county, Massachusetts, June 30.

There are now in the hands of the engraver, cuts to accompany the specification of this apparatus; and we have also in possession authentic statements of the very satisfactory results produced by it, which we shall also publish at an early day.

276. For *Dumb Stoves for Parlours;* John G. Treadwell, city of Albany, New York, June 30.

In this dumb stove there is what is denominated a heat compartment, so constructed, that when there is not fire in the stove below it, or when an increased heat is desired, a fire may be made in this heat compartment, and the heat consequently increased in any desired degree. The claim is to the manner in which the constituent parts of this apparatus are combined and connected together. The danger to be apprehended is that the two parts in question cannot be so combined as to prevent the occasional escape of smoke; should this not be the case, the advantage of the arrangement must be obvious.

277. For an improvement in the mode of *Constructing Castors, and applying them to Bedsteads;* Philos E. Blake, and John A. Blake, New Haven, Connecticut, June 30.

The wheel of the castor is inserted between two cheeks, at the lower end of a revolving axis, in the usual way, but the axis is of greater length and thickness than usual, being about four inches and a half long, and from half an inch to three eighths in diameter. A hole is bored in the axis of the post to admit this shaft, and into this hole is driven a cylindrical piece of metal; into a conical cavity on the lower end of this, the upper end of the axis enters; the lower end of the axis is embraced by a collar, likewise driven into the wood, and this completes the apparatus, which it will at once be seen is of the most simple and permanent character.

The claims need not be given, as they are intended to embrace the foregoing construction. They will, undoubtedly, sustain the patent, although they are so worded as to appear more like a claim to results than to means.

278. For an improvement in the mode of *raising and lowering the grates of Stoves;* Josiah Dutcher, city of New York, June 30.

Grates have been raised and lowered by racks or pinions, and by other means; the claim made in the case before us is to the raising them by means

of two cams placed on a revolving shaft below the grate; which cams are in form one quarter of an ellipsis, or oval.

Specifications of American Patents.

Specification of a patent for manufacturing a White Pigment to be used as a substitute for White Lead in Painting. Granted to William Cumberland, *city of New York, June 7*, 1838.

To all whom it may concern: Be it known, that I, William Cumberland, of the city of New York, in the state of New York, have invented a new and improved process for manufacturing a white pigment, with a basis of lead, to be used as a substitute for white lead, for painting, when ground in oil, or in any other fluid, according to the nature of the work to be performed. And I do hereby declare that the following is a full and exact description thereof:—

The first operation in preparing my white pigment is to obtain a protoxide of lead by triturating metallic lead in water, to which I in general add a portion of caustic soda, to facilitate the process. This production of a protoxide of lead by trituration is now practised in some manufactories of carbonate of lead, and is not of my invention, but the means which I have adopted of effecting it facilitates the process, and is as follows: I granulate the lead by fusing it, and pouring it into water, in the ordinary way. This lead I put into a triturating vessel, differing in construction from the cylinders usually employed. This vessel is somewhat in the form of a saucer, or bowl, so as to expose a considerable surface to the action of the atmosphere; it may be of cast iron, and of such size as shall adapt it to the quantity of work to be performed. An iron shaft passes through the axis of this vessel and is attached to it so that they may revolve together. The shaft is inclined twenty-five degrees, more or less, from the perpendicular, and motion is communicated to it in any convenient manner.

Into the vessel so constructed I put my granulated lead, with as much water as may be requisite, adding about an ounce of caustic soda to every four gallons of water. The revolution of the axis, combined with its inclination and that of the triturating vessel, causes the granulated lead to roll over, and thus produces the necessary friction among its particles, and also the requisite exposure to the influence of the atmosphere, in the most advantageous way. This operation is usually kept up for about twelve hours, when the oxide of lead which has been formed, and which is of a pale yellow colour, is separated from the metallic lead, and well washed. During the process, portions of water are added to supply any loss by evaporation or otherwise.

The accompanying drawing represents a machine which I have invented for this purpose. The frame work may be differently constructed, all that is necessary being so to form it that the shaft on which the triturating vessel is fixed, and with which it revolves, may be placed at an inclination from the perpendicular of from 25 to 45°, more or less. Fig. 1 represents a vertical section of the triturating vessel, and its shaft, F, F, is the body of the vessel, which has a rim, G, at its upper part, sloping inwards, to retain the water and lead; the inclination of this part being proportioned to that given to the axis. I, is a hub of lead, surrounding the shaft, E, E, to prevent the lead from coming into contact with it. J, J, is an iron bed, or cup, which

serves as a seat for the triturating vessel, supporting it, particularly when made entirely of lead. In fig. 2, A, A, are two upright posts supporting the cross timber, B, which sustains the upper end of the shaft E, E; there being at its lower end a sill timber, c, and stop, D. A cog or band wheel, H, may occupy any situation on the shaft, which may be found most convenient. The shaft need not run through the vessel, but may be supported in a collar below it. The body of the vessel may be made entirely of lead, or of any other metal, and lined with lead; its form may be varied considerably, it only being necessary that its characteristic properties be carefully preserved.

I have thus given the mode of producing the protoxide which experience has shown to be a very good one, and I believe the best; but I do not limit myself to this particular mode of forming the protoxide, but occasionally take this oxide prepared in any other way, and submit it to the subsequent operations by which the pigment in question is formed.

The yellow protoxide, produced as above, or the protoxide obtained in any other way, is to be placed in a vessel, with a considerable quantity of water, and diluted sulphuric acid is then poured among it, agitating the mixture not only during the pouring, but for a considerable space of time, and it will be found that the protoxide of lead will be thereby converted into a white pigment, which is a peculiar sub-sulphate of lead, possessing properties not found in the ordinary sulphate of lead; the quantity of sulphuric acid required will be about two pounds to every twenty pounds of the oxide. The ordinary sulphate is obtained by precipitating the lead from any of its soluble salts by means of sulphuric acid; as from the acetate or nitrate of that metal; the sulphate so produced will be a white powder, but it will not possess the body, or other properties, which fit it to be substituted for the carbonate of lead in painting; whilst that prepared in the way which I have indicated will be found to possess these properties in an eminent degree.

What I claim, therefore, as my invention, and wish to secure by letters patent, is the above described mode of producing a white pigment with a base of lead, by pouring the sulphuric acid into the mixture of water and the protoxide of lead, in the manner, and for the purposes, herein set forth. I also claim the triturating vessel, constructed substantially in the way described.

William Cumberland.

Remarks by the Editor.—Although a white pigment may be produced by the process described, it is believed, and this belief is strengthened by information obtained from a credible source, that this pigment will not possess the body necessary to render it a substitute for white lead; it is also said not to retain its colour, but to become yellow. Time enough has elapsed since the issuing of the patent to bring these things fairly to the test, but from some cause or other, the manufacturing of the article in the large way, which was commenced in New York, has been suspended, and we are, therefore, without that kind of information which a full and fair trial alone can furnish. We have given the references to the triturating machine, but have not deemed it of any importance to accompany it with an engraving.

Specification of a patent for imparting to Articles of Iron and Steel an increase of strength. Granted to WALTER R. JOHNSON, *city of Philadelphia, June* 30*th*, 1838. *Antedated December* 30*th*, 1837.

To all to whom these presents shall come: Be it known, that I, Walter R. Johnson, of the city of Philadelphia, in the state of Pennsylvania, have invented a new and useful improvement in the manufacture of wrought or malleable iron and steel, and of articles formed thereof; being the imparting to said materials of an increase of strength, by means of a process which I call thermo-tension, and that the following is a full and exact description of carrying into effect my said improvement.

The said process is founded on the principle that the strength of said materials is increased by means of mechanical stretching, or straining, at a high temperature.

I perform the said process in the following manner: I first determine in the usual manner, by trial and calculation, what strain might, at the ordinary temperature of the air, and before my improvement has been applied to it, be sufficient to break the particular piece of metal, or manufactured article, intended to be improved by the process of thermo-tension.

I then, by means of any suitable apparatus for applying heat and measuring temperature, subject the piece or article to be strengthened, to a temperature not exceeding seven hundred degrees Fahrenheit, preferring that of five hundred and fifty degrees for most kinds of iron, not restricting myself, however, to the same temperature for all kinds of iron and steel, but varying to a higher or lower temperature, according as the same shall be found most serviceable for the particular kind which is undergoing the process.

When the proper temperature has been attained, I apply, by means of any suitable apparatus for applying and measuring mechanical strain, a force equal, or nearly so, to the calculated strength of the specimen or article under process, and continue to apply the same as long as the metal continues to be stretched by it.

I contemplate the application of the improvement and process above described, herein called the process of thermo-tension, to the metals, wrought or malleable iron and steel of whatever form, in which an increase of direct cohesion may be found useful, whether the same have been manufactured by rolling, hammering, drawing, or by any other process, as I do not confine my improvement to any particular form of materials, or of articles manufactured therefrom.

What I claim as my improvement in the art of manufacturing iron and steel, and of articles formed therefrom, is the submitting of them, while at high temperature, to mechanical stretching, or straining, as above specified, for the useful purpose of increasing their direct cohesion, by whatever means the necessary force shall be applied, and measured, or the requisite temperature communicated and regulated.

WALTER R. JOHNSON.

Progress of Practical and Theoretical Mechanics and Chemistry.

Advantages of Compressed Peat, or Turf, as a fuel for Steam Engines, and in the Reduction of Iron Ore.

From a communication addressed to the London Journal of Arts, Sciences, and Manufactures, by C. W. Williams, it appears that by a compression of the upper portions of peat or turf bogs, and working the condensed material, a compact fuel may be obtained, surpassing, in strength and other good qualities, the best coke obtained from bituminous coal.

The following extract presents the results of the experiments:

In pursuing the inquiry as to the manufacture of turf coke, I fell naturally into the common error of taking the lower portions of the bog in preference to those nearer the surface; and from this circumstance, that the latter, on account of their lightness, appeared wholly unsuited to the purpose; while the former, from their greater comparative density, seemed alone available in producing a coke which could stand the blast. From the lower strata a sufficiently dense coke could be formed, by the aid of suitable coking stoves; but it was found to be so impure, and impregnated with so large a proportion of incombustible and deleterious matter, as to have an injurious effect on iron, from an acid which it was supposed to contain. From the upper strata, and particularly where they were composed of bog moss, which had made but little progress towards decomposition and solidification, I obtain an exceedingly pure carbon, giving a very small per centage of useless, and no injurious, matter. This upper portion of the bog, however, was of so light and porous a texture, and so apt to re-absorb moisture, by which its heating properties were much reduced, that it would scarcely repay the labour of cutting and saving, even for domestic fuel, while the lower strata, on the contrary, often approached the solidity of coal. This superior density had been acquired, in some degree, by the decomposition and consequent solidification of its vegetable fibre, but still more, by the consolidation, through ages, from the pressure of the superincumbent mass, often to the depth of twenty or thirty feet. But this great density, valuable as it may be, had been obtained at the expense of its purity and heating properties, by the addition of many heterogeneous and incombustible substances; and which, *pro tanto*, and without reference to their chemical effects, deteriorate its calorific power and usefulness as a fuel.

I may here observe, that I have burned the compressed peat coke, which forms the subject of the following analysis, in a small room, in a stove resembling Joyce's stove, standing on the table, for four days and nights successively, during which it was never extinguished, and, without any perceptible unpleasant smell, or other annoyance.

Now, having thus ascertained that the upper and lighter portions of the bog had the greatest purity and heating power, weight for weight, the difficulty presented itself of combining density with purity, and which in the natural state do not co-exist.

In this I have completely succeeded, having obtained a coke, from the lighter portions of the bog, possessing not only double the density of wood charcoal, and equal to that of coal coke, but possessing that purity which is so essential in the working of iron. To ascertain the relative values of the compressed peat, and peat coke, as compared with coal, coal coke, and

charcoal, I had a very accurate analysis made by that able experimenter, Mr. Everitt, and whose report I here subjoin:

Report of Experiments on Pressed Peat, and on Coke made therefrom.

DENSITY.—The density or specific gravity of water, . . .	1000
Compressed peat, the thinnest and hardest pressed, . . .	1160
Ditto, the thicker, or less pressed, ...	910
Peat coke, the thinnest or hard pressed, ...	1040
Ditto, the thicker or less pressed, ...	913
The resin fuel, ...	1140
The resin alone, ...	1110
The hardest and dry woods, such as oak, ash, elm, vary from	800 to 885
And the lighter woods, such as poplar, pine, &c., from	383 — 530
Charcoal from hard woods, varies from	400 — 625
Coals vary from	1160 —1600

Hence we see that the hardest compressed peat is denser than the hardest woods, in the relation of 1160 to 885; and compared with some of the lighter woods, nearly double. Further, that the coke prepared from the hardest compressed peat, is nearly double the density of ordinary charcoal. In common practice, it is reckoned that 100 lbs. of charcoal occupy the same space in a measure as 200 lbs. of coke. The peat coke would, weight for weight, occupy the same, very nearly, as common coke.

CALORIFIC POWER.—The next point of investigation was the calorific power, as compared to coal, common coke, and charcoal.

The usual method of making assays of this kind, is to burn weighed quantities of the respective fuels, and endeavour to ascertain how much water each respectively will raise a given number of degrees, or convert into vapour. But experiments of this sort, unless made on a very large scale, cannot lead to any comparable results. It is given in Berthier, (Essais par la voie seche, vol. i., p. 289,) as being the result of accurate experiments, that a given weight of charcoal will raise 78 times its own weight of water from 32° to 212°, or boil off in vapour $11\frac{1}{10}$ its weight: which data do not differ materially from the results obtained on a large scale, by J. Parkes, (see his paper in the Transactions of Civil Engineers," vil. ii., p. 161.) Now we know, from actual trial, that weighed portions of coke, charcoal, &c., used under stills and boilers, holding only from 5 to 10 gallons of water, will not produce $\frac{1}{10}$ of this effect. I am here convinced of the utter futility of trusting to any such experiments on a small scale, with the view of having any thing like an approximation to the true relative values of fuel; even in the best constructed calorimeters, where only a pound or so of the fuel is consumed, it is very difficult to command uniformity through any two experiments. I was here induced to adopt the method recommended by Berthier, in his work, vol. i., p. 228, in order to obtain the relative values of these fuels.

It is assumed, from the results of almost all experiments, that the absolute quantity of heat generated, during the combustion of any fuel, is in exact relation to the quantity of oxygen consumed on entering into combination: hence in order to ascertain the relative calorific powers of fuels, it is only necessary to ascertain the quantity of oxygen each consumes in burning.

The best mode of doing this is to mix a weighed quantity of the fuel with a slight excess of litharge, (oxide of lead) and find what quantity of metallic

lead is reduced. It is to be remarked, that this method cannot be applied to such fuels as contain any volatile matter, from Berthier, (and which also agreed with some trials made by me on the same substances.)

10 parts of pure carbon will give of lead	. .	340 grs.
10 parts of good wood charcoal, from	. .	300 to 323
10 parts of dry woods, from	. . .	120 — 140
10 parts of good coke, from	. , .	260 — 285

It may be here remarked, that assuming the principle, which is the foundation of this mode of assaying, to be correct in practice, it is susceptible of great accuracy; for, as every *single grain* of carbon produces 34 grains of lead, any error in estimating the lead is reduced to $\frac{1}{34}$th in estimating the carbon.

The following results are averages of two, and sometimes three, experiments on the same fuel; and in many cases the metallic lead in two consecutive trials did not differ more than 2 grains, which corresponds to only $\frac{1}{17}$th of a grain of pure carbon.

10 parts of the peat coke—this was picked surface peat—gave	277
10 parts of peat coke, lower strata, ...	250
10 parts of the pressed peat, ...	137

The resin fuel, containing so much volatile matter, could not be tried in this way; and its calorific value could not be ascertained from the difficulty of arriving at any satisfactory result, except on a large scale,

The above numbers represent the relative quantities of heat which can be produced by the same quantities of each of the fuels; and in cases where quantity of heat alone is the consideration, these numbers will also represent their relative values.

But intensity of heat is often of more consequence than quantity; and intensity depends very much on the density of the fuel. Thus, charcoal can never produce so high a heat as coke; and, in this respect, the denser peat coke and common coke are about equal. These comparisons are quite irrespective of any foreign matter being present which may be injurious to the quality of iron, where the fuel is used for reducing the metal from its ore, or for working iron by fire generally, or when it is used under iron boilers for generating steam.

To see how far it was probable or not that the peat coke contained matter likely to act injuriously in this respect, like some coke, portions were burnt in a variety of ways, when no sulphurous acid smell could, in any case, be perceived; sulphur, or metallic sulphurets, are the usual ingredients in common coke, to which their corrosive effects on iron boilers is to be attributed; and such coke, during burning, always gives very perceptible quantities of sulphurous acid gas.

As the nature and quantity of ash is sometimes of importance, I have also investigated these points with great care.

An average of two experiments, where 1000 grains of peat coke (made from the surface peat) were burnt till all carbonaceous matter was consumed, gave $\frac{5}{100}$ for the quantity of ash of a light buff colour.

100 grains of such ash contain common salt,	3. 5
Silica—sand and silica combined,	15. 0
Sulphate of lime,	22. 5
Carbonate of lime,	43.25
Magnesia and carbonate of magnesia,	15.00
Alumina,	0.75
	100.00

The ash contained no carbonate of potassa, and is remarkable for the large quantity of magnesia present.

From my trials I am of opinion,—1st, That the peat coke examined by me contains nothing which would, during the burning, be more injurious to iron than wood charcoal or the best coke—whether it be used to work iron, or under boilers for the generation of steam,

2d. That it is equal to the best coke, weight for weight; in heating power, a little inferior, weight for weight, to wood charcoal, where quantity of heat is the only consideration; but where bulk of stowage, and high intensity of heat are important considerations, it is superior to wood charcoal.

Thomas Everitt.

London, Jan. 18, 1839.

The above analysis was made on turf from Lancashire; but, from other experiments, I find the turf from many of the bogs in Ireland exceeding it in purity, and containing a much smaller proportion of incombustible matter.

In considering the foregoing report and analysis, the great density of both the peat and peat coke, though produced from the lighter portion of the surface turf, is remarkable; the compressed peat being 30 per cent. denser than oak wood, and double that of the lighter woods, while the coke is double the density of charcoal, and on a par with coal coke.

I may here add, that this density, which is so valuable where intensity of heat is an object, may be still further increased, and with little additional expense.

This being the first time that the results of the litharge test, as applied to turf coke, has been communicated in this country, the value of which Berthier, in his elaborate and admirable essay on combustible bodies, has fully established, I may be permitted to say, that its accuracy, and the small amount of practical error to which the process is liable, as shown by Mr. Everitt, gives it a high claim to our attention, although to persons not familiar with the nature of chemical tests, it may not be so self-evident. We here see that the extraordinary attraction which carbon has for oxygen, and the power which it thereby exercises of de-oxidizing metallic oxides, renders the litharge test the most suitable for determining the absolute purity and calorific powers of the various cokes, at least on a small scale. The carbon, under a high temperature, uniting with the oxygen in proportion to its calorific powers; while the lead, being thus deprived of that which is essential to its state of oxide, is precipitated in its pure metallic form, the relative weights so thrown down, representing the true combustible values of the several cokes.

It will be observed that Mr. Everitt, in stating the quantity and intensity of the heat given out by peat coke, adds, that these are irrespective of the presence of any foreign matter which may be injurious to the iron. Now, we know that many foreign substances do enter into the composition of coal

and coke, and do exercise a very injurious influence over iron and steel in the furnace and forge. In this respect, the importance of the peat coke becomes apparent; iron is not only sooner brought by it to a welding heat, but it is found to work softer, and with less of that scaling which is so injurious, particularly in the operation of welding.

These facts I have proved both in the furnace where large boiler plates are heated, and in the operations of the forge where even the worst iron was improved in quality.

It is not an unimportant consideration that peat coke may thus be produced from that portion of the bog which has ever been rejected as a domestic fuel, when a denser kind is to be obtained. Again, that it is precisely that description of turf which most abounds in Ireland; and in most of the large bog districts has hitherto been regarded as an absolute incumbrance, alike unfit for fuel, and for conversion to agricultural purposes. This arises from its extreme porousness and levity—its being so far removed from that decomposition which is essential to the vegetative functions of all soils, and also to its susceptibility of the extremes of excessive moisture and excessive drought—overcharged in wet seasons, and amounting to a mere *caput mortuum* in dry ones.

The resin fuel, alluded to in the foregoing report, is an artificial coal, formed by a union of this peat coke and bituminous matter up to the point of saturation. Of the uses and properties of this fuel, as well as of other advantages derivable from the application of peat, I shall, with your permission, on a future occasion submit to your consideration.

C. W. Williams.

Preventing the Oxidation of, and Colouring Metals.—Messrs. Elkington and Barratt's Processes.

Messrs. Elkington and Barratt's invention consists of certain modes of coating metals with zinc, and zinc and mercury; and a mode of colouring iron and steel.

In order to coat copper and brass with zinc, there are mixed in an earthen vessel seven parts of muriatic acid, (specific gravity about 116,) and 100 parts of water, both by weight; and to these are added four parts of zinc, in the state of powder, or pieces. These articles are allowed to remain twenty-four hours, or until the acid and zinc cease to act upon each other, and the solution thus obtained is poured into a convenient vessel for boiling it, adding a quantity of zinc in powder, or in thin pieces. While boiling, the articles to be acted upon are immersed therein, bringing them into contact with the metallic zinc, and they will speedily become coated therewith. They are then removed, and washed with water and dried. In using this solution of zinc, if the articles are of iron or steel, they are previously coated with copper; and this is effected as follows: the articles are first cleansed or pickled in dilute sulphuric acid, composed of one part concentrated acid to sixteen parts of water; and having prepared a solution of sulphate of copper, commonly called blue vitriol, the iron is immersed therein while cold, for a few seconds, and speedily removed and washed. This is repeated one, two, or three times, or until it is found that the iron is perfectly coated; care must be taken not to allow it to remain too long in the solution of copper, or the copper precipitated on the surfaces becomes loose. If a strong coating of zinc be required, the processes of coppering and zincing are repeated,

and it has also been found, that if the articles, when of copper, or if of iron, after they have been coppered, are introduced into a dilute solution of nitrate of mercury, and then again boiled in the solution of zinc, that the same object is obtained. The nitrate, or any other convenient solution of copper, may be substituted for the sulphate.

Another process is as follows: take dilute muriatic acid in about the proportion of one part acid (the specific gravity 116,) and thirty parts of water, into this introduce a quantity of zinc, in powder or in small pieces. The articles of iron are then to be placed in the acid, and kept in contact with the zinc during the process, which will require from two to five minutes, or until they are evidently coated with zinc; then remove, wash and dry them, as before.

Various metals, as iron, steel, copper, brass, &c., may be coated with the amalgam of zinc, and although this may be effected by using the two metals, in almost any proportions, it has been found that six or seven parts of zinc, with one part of mercury, will answer best; these are amalgamated by heat, or by agitating the two metals in contact with dilute muriatic, or other convenient, acid; the zinc being previously granulated, or reduced to small pieces. To this amalgamated zinc, when effected by heat, add dilute acid, as before, and then introduce the articles, which may require to be kept occasionally stirred. Instead of using the muriatic acid, some salts are employed, as the muriate, or sulphate of ammonia, in the proportion of one of salt to thirty ounces of water, or thereabout; and other acids than the muriatic may be employed, as ascetic, sulphuric, &c., and which require no other directions than to employ them of about the same strength as directed for the muriatic acid. It is preferable to employ these solutions in a hot or boiling state, as the effect is thereby obtained in a shorter period; but the processes where the free acid is used, may be successfully performed in a cold state, the acid and water to be added occasionally, as the solution becomes reduced in strength or quantity, by the boiling or action upon the metals to be coated.

An amalgam of zinc may be employed in a melted state for some articles, in which case, and particularly if they are of iron, they require to be well pickled or cleaned, and also to be immersed in a solution of muriate of ammonia, to induce the perfect adhesion of the amalgam, which amalgam may be varied in almost any proportion of the two metals; but the proportions now given are considered best.

The oxides of the metals may also be used in the same manner, instead of the metals, or in conjunction with them; as, for example, a solution of zinc may be made with the oxide of that metal, instead of using the metal itself, and so also with the oxides of mercury. Messrs. Elkington and Barratt's processes may be applied in connexion with the means patented by Messrs. Craufurd and Fontainemoreau.

The process for colouring metals is as follows:—To colour iron and steel to imitate brass; first wet the iron or steel by means of a solution of copper, as already described, and having afterwards boiled it in the saturated solution of zinc, having excess of zinc therein, until perfectly covered, remove it and dry it in sawdust, and then submit it to heat in a closed oven, until the required colour is obtained, and which is easily observed by looking occasionally at the articles during the process. They are afterwards to be pickled in a dilute acid, and washed and dried.

A process called "Similoring," from the words "*simile l'or*," has been before practised for colouring copper and brass, and which consists in ob-

taining on the surface a thin coating of zinc, and submitting the articles so prepared to the action of heat, till a colour approaching to that of gold is obtained. The object of the present invention, so far as it relates to coating copper and brass, is to obtain a good and sufficient coating of zinc on the surfaces, in order to prevent or retard oxidation. The use of heat is omitted, which would be prejudicial to the coating of zinc.

Local Attraction in Iron Vessels.

On Friday evening, the 22d March, the Theatre of the Royal Institution was crowded to hear Dr. Faraday's lecture on the plan recently introduced by Professor Airy, the Astronomer Royal, for neutralizing the effect of iron steam vessels on the compass.

It is well known that this valuable and indispensable instrument has hitherto been quite useless in these vessels, unless removed to a most inconvenient height above the decks. This was noticed by Lieut., now Capt., W. Allen, in the Alburka, in Lander's last expedition to the Quorra; and as another instance, it is related of the Rainbow, the iron steamer on board of which Mr. Airy's experiment was made, that her commander, at the close of a most anxious voyage from Liverpool, (where the vessel was built) was so much at a loss about his situation when off the Isle of Wight, that he was obliged to ask a fisherman where he was; on being told that he must steer E.S.E. (we think it was) to gain his port, he replied that he would give a good deal to know in what direction E.S.E. was, for being in an iron vessel, his compass was useless.

It was on the arrival of this vessel at Woolwich, that Professor Airy was employed to institute his inquiries respecting the best means of rendering the compass available in iron steamers.

Dr. Faraday, in giving a general account of the method adopted by the Professor in his experiments, illustrated his subject by means of a large plate of sheet iron, which represented the vessel, above and towards one end of which, a horizontal magnetic needle was placed, similar in position to the binnacle compass. The sheet of iron was then made to traverse on a central pin placed immediately under the needle, by which arrangement the process of swinging the vessel was very simply exemplified.

Mr. Airy, we are informed, having swung the vessel in the usual manner, ascertaining for each point of the compass the magnetic variation, and then by vibrating the needle under similar circumstances, he also obtained the comparative magnetic intensity. By the application of mathematical reasoning to these data, he was enabled to estimate the general direction and amount of the disturbing force, which was thus so michievously exerted in the needle, and to counteract which a remedy was now to be sought.

From the extraordinary effects exhibited on the needle during these investigations, the inference previously drawn by Capt. Johnson from his interesting experiments on board the Garryowen, in 1837, was confirmed, namely, that the iron vessel did not act merely by inductive influence as a mass of self iron, but as a regular and permanent magnet, exhibiting the effects of determined polarity.

Professor Airy, under these circumstances, has employed artificial magnets as "correctors," and so places them as to neutralize the effect of the vessel, and thus leave the needle subject to the earth's magnetic influence alone. It is obvious that the position of the "correctors" must be ascertained by separate experiments for each vessel.

Dr. Faraday stated that the Professor's plan had been tried with complete success on board the Ironsides, in her voyage to South America, and also on board the Rainbow, on her recent trip to Antwerp, but it can scarcely be expected that the complete success of this ingenious method of Professor Airy's should be securely established without much longer experience. When we consider the very complicated character which a vessel, considered as a magnet, must under all circumstances present, her extreme liability to change her magnetic condition by concussion, by alteration of trim, &c., and when we further take into account the effects consequent on change of temperature, and on the vessel's removal from station to station on the earth's surface, we may reasonably expect that the plan will still meet with many practical difficulties, ere it can be pronounced perfectly successful. Much, however, has been effected, and we cannot but congratulate the public on the introduction of a plan so happily conceived, and thus far so successfully applied.

The compass is now no longer a useless instrument on board our iron vessels, and though much caution must still be exercised in its application, the principal difficulties seem to be removed, and the commanders of our iron vessels, with proper skill and care, may now perform these voyages, (the short ones at least) with confidence and comfort.

Dr. Faraday, in concluding his subject, suggested the propriety of some public person being appointed to superintend the application of these "correctors" whenever they may be employed, since the principle, however good in itself, if carelessly or ignorantly misapplied, might be productive of the most disastrous consequences. Lond. Naut. Mag.

Preparation of Prussian Blue. By Lewis Thompson.

In the usual mode of manufacturing Prussian blue, the requisite carbon and nitrogen are obtained by decomposing animal matter in contact with potash. In this process, the potash, being reduced to the metallic state, causes the formation of cyanogen, in consequence of its affinity for that substance. The quantity of nitrogen furnished by a given weight of animal matter, is not large, and, in the material employed by manufacturers, seldom perhaps exceeds eight per cent.; and of this small quantity, at least one-half appears to be dissipated during the process, thus producing an enormous waste of material, and at the same time increasing the size of the apparatus. Reflecting on these circumstances, it occurred to me that the atmosphere might be made to supply, in a very economical manner, the requisite nitrogen, if allowed to act on a mixture of carbon and potash, under favourable circumstances. The experiment proved, on trial, to be correct, and in some measure exceeded my expectation; for the carbonaceous matter employed may be worked over again many times, and is even improved by each operation. I found it necessary to use iron, for a reason which will be apparent in the explanation of this process; when iron is not employed, a much higher temperature is required.

To produce Prussian blue, the following method may be adopted, but experience alone can teach us the best proportions; and in this, as in most of the arts, the caprice of each manufacturer will probably lead to the adoption of various proportions of the ingredients used.

Take of potash, or pearlash, ...	2 parts;
Coke, cinders, or coals, ...	2 parts;
Iron turnings, ...	1 part.

Grind the whole together into a coarse powder, and place it in an open crucible, or other convenient vessel, and expose the whole for half an hour in an open fire to a full red heat, stirring the mass occasionally. During the process, little jets of purple flame will be observed to arise from the surface of the mixture; when these have almost ceased to appear, which will happen in about the time specified, the whole must be removed from the fire, and allowed to cool: water is now to be added, so as to dissolve the matter soluble in that fluid, and the black matter remaining put aside for another operation. The solution, after being filtered, is to be mixed with one part of copperas, and muriatic acid added in the usual way, to brighten the colour of the precipitate. The quantity of Prussian blue produced from a given weight of pearlash or potash is generally about one-fourth of the weight of the pure potash contained in the salt; but the larger the quantity operated upon at one time, the larger is the relative produce. Thus six ounces of pearlash, containing 45 per cent. of alkali, yielded only 295 grs. of Prussian blue, whilst one pound of the same pearlash yielded 1355 grs. The Prussian blue here spoken of, is the pure perferrocyanate of iron.

In this process, the potash is decomposed by the iron, producing potassium, which, being volatile, rises and combines with the carbon of the coke and with the nitrogen of the atmosphere, the oxygen of which has been removed by passing through the fire, or by the coke or cinders. In the mixture, the cyanide of potassium thus formed is next dissolved in water, and furnishes ferrocyanate of iron on the addition of sulphate of iron and muriatic acid, according to the explanation given in most chemical books.

By deflagrating a mixture of nitrate of potash, coke, or small coals, and iron turnings, a mass is obtained which furnishes abundance of Prussian blue; but, in this case, the nitrogen is derived from the decomposition of the nitric acid of the nitrate of potash, for the experiment succeeds equally well in a close vessel. In these experiments, soda may be substituted for potash without affecting the result: the charcoal from most kinds of vegetables cannot, however, be employed in place of that from coals, as it is very porous, and burns away too quickly. The presence of cyanide of sodium in barilla, kelp, and English alkali, is thus easily accounted for; and the small quantity of cyanide of potassium invariably produced during the process of preparing potassium, admits of a similar explanation. Trans. Soc. Encour. Arts.

Reagent for Nitric Acid and Nitrogen. *By* Desbassayns de Richemont.

The mode of detecting the presence of nitric acid proposed by De Richemont is exceedingly delicate, and depends upon the fact, that a mixture of a concentrated solution of protosulphate of iron and sulphuric acid becomes coloured rose red by the addition of deutoxide of nitrogen, (*Stickoxyd*) or even purple, if the latter is present in larger proportion: the quantity of the nitric oxide necessary for the production of this tint is so small, that an exceedingly minute portion may be detected by it. To detect the presence of nitric acid, add to a small quantity of sulphuric acid the solution to be examined, in such a proportion that the quantity added should equal three-fourths the bulk of the acid. When the mixture has become cool, drop in a concentrated solution of protosulphate of iron, which, if any nitric acid is present, decomposes it, causing the evolution of nitric oxide, which produces the rose-red or purple tint above alluded to. This mode of operating will allow us to detect one part of nitric acid in 24,000 of water.

For the detection of nitrogen gas, De Richemont directs the gas under examination to be mixed with from 3 to 6 times its volume of a mixture of oxygen and hydrogen, (in equal vols.) and the whole detonated in a Eudiometer by the electric spark. The fluid that bedews the Eudiometer after the explosion, is to be mixed with sulphuric acid, to which a few drops of protosulphate of iron in solution have been added: the fluid will assume the rose-red tint if the minutest portion of nitrogen is present. It is of course necessary to avoid any source of fallacy arising from the presence of atmospheric air in the oxygen and hydrogen employed. The action of sulphuric acid in producing this rose colour is so remarkable, that when we have failed in detecting the presence of nitric acid by the ordinary process, from its being present in too small a quantity to tinge the sulphate of iron *brown*, the addition of concentrated sulphuric acid will determine the production of the rose-red tint, if any nitric acid existed in the fluid under examination.—*Journ. für Pract. Chemie.* 5, 207. Lond. & Ed. Philos. Mag.

Quantity of Air required for Respiration.

A great difficulty existed in attempting accurate conclusions, from the diversity of constitutional temperaments, different states of humidity of the atmosphere, the state of insensible perspiration, and also from the admixture of small quantities of foreign gases; in one instance the admixture of $\frac{1}{5000}$ part of sulphuretted hydrogen, was enough to "knock up" a whole room, producing very serious effects. The degree of light was also an important element, ten per cent. of carbonic produces much oppression in the dark; but if strong light be admitted, it becomes tolerable. Dr. Reid stated that at St. Petersburgh, he was informed by Sir I. Wiley, that the cases of disease on the dark side of an extensive barrack, were in the proportion of three to one, to those on the side exposed to strong light, and this uniformly so for many years. Dr. Reid explained the mode he had adopted to ventilate the House of Commons, which he illustrated by diagrams, and demonstrated by the exhibition of a glazed model of the House. The current of fresh air could be introduced either from below or from above, diffused uniformly, and not by violent draughts, but, as it were, insensibly, and was under the most exact control as to quantity. The air, when used for the purposes of respiration and combustion, was conveyed away in an opposite direction from that in which it had been introduced. In answer to a question, Dr. Reid said that he had taken no account of the product of the combustion by which the heat and light were produced, as these products should be omitted in all calculations on the subject. They, if possible, should be carried off so as not to interfere with the immediate supply to each individual. For the purpose of raising the temperature, hot water was used in iron tubes, not raised above 150°. Dr. Reid also stated, in answer to other questions, that he had not made any particular observations on the modifying influence of different articles of clothing, but he believed they did modify considerably the question, those being preferable that were of a very porous nature, allowing an *insensible* application of the atmosphere to the cutaneous surface. *Trans. Soc. Adv. Sci.* Athenæum.

Machine for Raising Water by a Hydraulic Belt. By Mr. Hall.

In this machine, an endless, double, woolen band, passing over a roller at the surface of the earth, or at the level to which the water is to be raised,

and under a roller at the lower level, or in the water, is driven with a velocity of not less than 1000 feet per minute. The water contained betwixt the two surfaces of the band is carried up on one side, and discharged at the top roller by the pressure of the band on the roller, and by centrifugal force. This method has been in practice for some time in raising water from a well 140 feet deep in Portman Market, and produces an effect equal to 75 per cent. of the power expended, which is 15 per cent. above that of ordinary pumps. This method would be exceedingly convenient in deep shafts, as the only limit is the length of the band, and many different lifts may be provided.

Mr. Hawkins had seen a machine very similar, fifty years ago.—Mr. Donkin, without entering on the question of originality, stated that he had seen a machine of this description working with a beneficial effect of 75 per cent., the beneficial effect of ordinary pumps being about 60 per cent. Ibid.

Progress of Physical Science.

A Series of Facts and Observations respecting the Natural Causes of Arborescent or Dendritic Figures in the two divisions of Animal and Vegetable Substances, and in Mineral Formations. By Sir Anthony Carlisle, F. R. S.

These ramifying figures are not the special productions of living bodies, because they also occur in mineral formations, and when they are not the impressions of organized structures.

In some instances of organic nature, arborescent figures depend on tubular vessels, as in animals; but in vegetable structures these figures are composed of solid woody fibres, while the frame work of the wings of insects consists of a solid horny substance.

For the advancement of natural knowledge, and for the improvement of organic physiology, it may be useful to collect and to collate various evidences, in order to establish the laws which direct the formation of similar figures in different bodies.

In many cases, the progressive steps of physical causation are more apparent in mineral bodies than in the complicated and living structures of animals and vegetables; and these examples of resembling figures will, therefore, commence with minerals which present dendritic figures, uninfluenced by the disturbing actions of vitality.

The most simple, and one of the most common examples of dendritic figures, occurs in the manufacture of the cheapest sort of ornamented pottery ware termed the "Mocha pattern." These picturesque figures are made by children who are entirely ignorant of the art of design. While the vessel is in the unglazed state termed biscuit, it is dabbed in given places with a liquid pigment which runs by descent, as the surface of the vessel is inclined, and thus it instantly spreads from trunks into regular subdividing branches; the rough surface of the biscuit and the gradual thickening of the liquid pigment producing these appearances.

Streamlets similarly divaricating, appear on the sea shore where little pools of water remain embanked by sand. The water oozing through the sand issues in streams, and these subdivide, according to the declivty, into arborescing streamlets, which sometimes again reunite into

larger branches, as in the anastomoses, between arteries and veins of animal structures. The same appearances often occur upon clayey or muddy declivities over which streamlets of water flow.

Dendritic figures are also common in many stones which were formerly regarded as petrifactions of previously organized structures. In the compact marly limestone, called lithographic stone, these figures often occur, and generally on the surfaces of laminæ, by which it would seem that the ochry pigment had percolated and spread in the same manner as that described respecting pottery. The moss-agate, certain marbles, and Mocha stone, exhibit similar dendritic figures. The entire bodies of certain corallines assume an arborescent character, as in the *Corallina muscosa* of Ellis.

The next examples of arborescent evolutions occur in the solid woody frame work of the leaves of trees, as displayed after the membranous or parenchymatous substance has been removed by maceration; and a remarkable example of an accommodated structure of leaves happens in the *Ranunculus aquatilis*, in which the floating leaves possess an entire covering of skin, while the submersed leaves are subdivided like those of fennel, as if the water had stopped the evolution of the skin, rendering the organ more like the gills of fishes.

For the better understanding of physiological, and consequently of pathological, phenomena, it is very important to distinguish between physical causes of general influence, and the especial or peculiar causes termed vital, which belong conjointly to organized living bodies; and the facts now submitted must, I believe, lead to more exact and practical discriminations as to the causes of embryotic evolution, the growth of organized parts, the reparation of læsions, and morbid deviations from natural structure.

If it be granted that arborescing vessels are only gross accommodations or appliances of convenience in animal function, and that they always originate under physical direction, and not from a vital or mysterious necessity, we may assume to have made one step further in natural knowledge.

These assumptions may, however, be justly supported by the unquestionable existence of entire,living,distinct animals and vegetables, devoid of arborescing vessels or ramifying fibres. The former occur in dropsical fluids and in uncysted tumours, which are termed globular hydatids; the latter in the *Tremella nostoc*. These hydatids are so far parasitical that they exist only in the natural fluids of living animals. The *Tremella nostoc* has probably a parasitical origin, since it always appears upon moist and decayed wood, or on dead leaves in the spring season.

Edin. New Philos. Journ.

Notice of the Electrical Excitation of a Leather Strap connecting the Drums of a Worsted Mill; in a letter to Dr. Faraday, *from the Rev.* T. Drury.

My Dear Sir:—Permit me to describe an extraordinary electrifying machine which I yesterday witnessed, and which I think will be new *even to you.*

It is no other than a leather strap which connects two drums in a large worsted mill in the town of Keighley.

The dimensions and particulars of the strap are as follows:

It is in length,	. . . .	24 feet,
Breadth,	. . . .	6 inches,
Thickness,	. . . .	$\frac{1}{8}$ do.

It makes 100 revolutions in a minute.

The drums, over which it passes at both ends, are two feet in diameter, made of wood, fastened to iron hoops, and turning on iron axles; these drums are placed at 10 feet distance from each other, and the strap crosses in the middle between the drums, where there is some friction; the strap forming a figure of eight. There is no metal in connexion with the strap; but it is oiled. If you present your knuckle to the strap above the point of crossing, brushes of electrical light are given off in abundance, and when the points of a prime conductor are held near the strap, most pungent sparks are given off to a knuckle at about two inches; I charged a Leyden jar of considerable size in a few seconds, by presenting it to the prime conductor. The gentleman who told me of this curious strap, has frequently charged his electrical battery in a very short time from it, and he informed me that it is always the same, generating electricity from morning to night, without any abatement or alteration. If this strap had the advantage of silk flaps and a little amalgam, it would rival the machine in the lecture room in Albemarle street.

Lond. & Ed. Philos. Mag.

Articles from the French Journals. Translated for the Journal of the Franklin Institute, by J. Griscom.

Changes of Temperature of the Globe.

M. Arago, in his eloquent "*Eloge historique de Joseph Fourier,*" after adverting to the surprising difference between the vegetation of the ancient and the present world, as is proved by the fossil Flora of France, England, Germany, Scandinavia, &c., which exhibit, for example, ferns 15 metres in height, and whose stems were a metre in diameter, and three in circumference, and mushrooms (lycopodiercées) which, under the most favourable circumstances of equatorial growth, are not more than a metre in height, attained, in the primitive world, in Europe, the height of 25 metres—thus proceeds:—

"The study of animal fossils is not less instructive. I should wander from my subject were I here to inquire into the manner in which animal organization was developed on the surface of the earth; what modifications, or rather what complications, it underwent after each cataclysm; if I even stopped to describe one of those ancient epochs in which the earth, the sea, and the atmosphere, were inhabited by cold blooded reptiles of enormous size; shelled tortoises three yards in diameter; lizards 18 yards in length; *petrodactyle*, real flying dragons, of form so singular, that one might, after examining the proofs, hesitate whether to class them among reptiles, among the mammalia, or among birds. My present design requires but little detail; a single remark will suffice.

"Among the bones which lie nearest the surface, are those of the hippopotamus, rhinoceros, and elephant. These remains of tropical animals are found under all latitudes. They have even been discovered in Melville Island, where the mercury descends to 50° below zero. In Siberia they are so abundant as to have become an article of commerce.

In fact, upon the steep shores of the frozen Ocean, not merely fragments of skeletons, but entire elephants, have been found, covered with flesh, skin and hair.

"I am mistaken, gentlemen, if every one of you has not drawn from these remarkable facts a consequence as remarkable, to which indeed the fossil Flora had already reconciled us,—that, as time advanced, the polar regions of our globe underwent a prodigious refrigeration.

"In explaining these curious phenomena, cosmologists assign no part to possible variations in the sun's intensity; and yet the stars, those distant suns, do not possess that constant or invariable splendour which is commonly ascribed to them. Some of them, in a relatively short period, are reduced to a hundredth part of their primitive intensity, and several of them have totally disappeared. The doctrine of attributing to the earth an original amount of heat which has been gradually undergoing a diminution or dissipation, is that which has been preferred.

"Agreeably to this hypothesis, the polar regions have evidently enjoyed, at very distant epochs, a temperature equal to that of the equatorial regions, which are now the abodes of elephants—although these regions are deprived, for months together, of the presence of the sun.

"The existence of elephants in Siberia did not originate the idea of a primitive terrestrial heat. It was adopted by some philosophers prior to the discovery of animal remains. *Descartes* believed that in the beginning (I cite his own expressions) *the earth differed from the sun only in being smaller.* It was therefore to be regarded only as an extinct sun. Leibnitz honours this hypothesis also by adopting it. He endeavoured to deduce from it, the mode of formation of the various solid strata of the globe. Buffon gave it likewise the weight of his eloquent authority. It is well known that this great naturalist regarded the planets of our system simply as portions of the sun, struck off from that body some thousands of years ago, by the stroke of a comet.

"In support of this igneous origin of our globe, Mairan and Buffon brought into view the high temperature of deep mines, especially that of the mines of *Giromagny.* It appears evident, that if the earth was formerly incandescent, we should not fail to discover in the inferior beds, viz. those which were the last in cooling, traces of their primitive temperature. The observer, who, in penetrating the earth, does not discover the heat to be increasing, might therefore consider himself fully authorized to reject the hypothetical conception of Descartes, Leibnitz, Mairan, and Buffon. But has the converse of this proposition an equal claim to our faith? May not the torrents of heat which the sun has been pouring upon the earth during so many centuries, find their way into the mass of the globe, so as to provide a temperature increasing with the depth? This is an important question. Certain minds, of easy credulity, conscientiously thought they had solved it, by urging, that the idea of a constant temperature was much the *most natural:* but wo to science if such vague considerations, which set criticism at defiance, furnished motives either for admitting or rejecting facts and theories! Fontenelle, gentlemen, would have traced the horoscope in these words, well calculated to humble our pride, but the truth of which is nevertheless unveiled in a thousand places by the history of discoveries: 'When a thing may happen in two ways, it is almost always in that way which seems to us, at first, to be the least natural.'

"Whatever the value of these reflections, I hasten to add, that in the

room of the unsubstantial arguments of his predecessors, Fourier substituted proofs and demonstrations, and we know what these terms imply before the Academy of Science.

"In all parts of the earth, when we descend to a certain depth, we find that the thermometer undergoes no variation, either annual or diurnal. It stands at the same degree and portion of a degree, throughout the year, and in every year. This is a fact; what says theory?

"Suppose, for a moment, that the earth may have constantly received all the sun's heat. Penetrate into its mass to a sufficient depth, and you will find, with Fourier, by the aid of calculation, a constant temperature for every period of the year. You will discover, moreover, that this solar temperature of the inferior beds varies in different climates; but that in each particular country, it must in fact remain always the same at depths which are small, relative to the radius of the globe. Well! natural phenomena are in manifest contradiction to this result. Observations made in numerous mines; observations on the temperature of the water of springs issuing from different depths, all give an increase of our centigrade degree for every 20 or 30 metres of depth. Thus there was some want of accuracy in the hypothesis we are discussing in reference to our fellow member. It is not true, that the phenomena of the temperature of the terrestrial strata, is to be attributed solely to the action of the solar rays. This being proven, the increase of heat observed in all climates, beyond a certain depth, is manifestly the indication of a proper or independent heat. The earth, as Descartes and Leibnitz would have it,—but without resting their opinion upon any demonstrative argument,—becomes (thanks to the accumulated observations of philosophers, and the analytical calculations of *Fourier*,) an *encrusted sun*, whose high temperature may be boldly invoked whenever the observance of ancient geological phenomena may call for it.

"After having proved that there is in our earth a heat proper—a heat whose source is not the sun, and which, if we may judge of the rapid increase which observation furnishes, must be sufficiently high, at the moderate depth of seven or eight leagues, to keep all known kinds of matter in constant fusion, the question occurs, what is its precise value at the surface of the globe; what part we must ascribe to it in the valuation of terrestrial temperature; what part it acts in the phenomena of life.

"According to *Mairan*, *Buffon*, and *Bailly*, this agency is immense. They estimate the heat which in France escapes from the interior of the earth, at 29 times in summer, and at 400 times in winter, that which is derived from the sun. Thus, contrary to general opinion, the heat of the solar orb, which enlightens us, constitutes but a very small portion of that whose happy influence we are enabled to enjoy.

"This idea has been developed with great ability and eloquence in the *Memoires de l'Academie*, in the *Epoch de la nature de Buffon*, in the letters of *Bailly à Voltaire, sur l'origine des Sciences, & sur l'Atlantide.* But the ingenious romance of which they serve as the basis, is dissipated like a shadow before the torch of mathematics.

"Fourier having discovered that the excess of the whole temperature of the earth's surface, over that which would result from the sole action of the sun's rays, has a necessary and determinate relation to the increase of temperature at different depths, he was able to deduce from the experimental value of this increase, a numerical determination of

the excess in question. This excess is the thermometric effect which the central heat produces at the surface. Now, instead of the high numbers adopted by *Mairan*, *Bailly*, and *Buffon*, what does our brother associate prove it to be? The *thirtieth* of a degree, and not more.

"The surface of the globe, which, in the origin of things, was perhaps incandescent, became then cooled down in the course of ages, so as scarcely to preserve a trace of its primitive temperature. Nevertheless, at great depths the original heat is still enormous. Time will notably change the internal temperature; but at the surface, (and the phenomena of the surface are the only ones which can modify or affect the existence of living beings) all the changes are, within a very small amount, accomplished. The frightful congelation of the globe, the period of which was fixed by Buffon at the moment when the central heat should be totally dissipated, is therefore a pure fantasy. On the outside, the earth is impregnated only with solar heat. As long as the sun shall retain its splendour, the sons of man will find, from pole to pole, under each latitude, the climates in which they have been enabled to live and flourish.

"These, gentlemen, are great and magnificent results. In consigning them to the annals of science, historians will not neglect to mark this singular fact, that the geometrician to whom we are indebted for the first demonstration of the existence, in the bosom of the earth, of a heat, independent of solar action, has reduced to nothing the immense part which this original heat was made to act, in explanation of the phenomena of terrestrial temperature.

"To the credit of having liberated the theory of climates from an error which had maintained its ground on the imposing authority of *Mairan*, *Bailly*, and *Buffon*, Fourier has claim to a merit still more splendid. He introduced into this theory a consideration till then totally neglected. He brought into view the part which the *temperature of the celestial spaces*, in the midst of which the earth describes its immense orbit round the sun, must act in the phenomena in question.

"Finding that even under the equator, there are mountains covered with eternal snow; observing the rapid decrease of temperature in ascending strata of the atmosphere, as ascertained in aerostatic elevations, meteorologists had concluded that in regions where the extreme rarity of the air must ever prevent the approach of man, and especially beyond the bounds of the atmosphere, a prodigious cold must constantly prevail. It was not only by hundreds, but by thousands of degrees, that they were disposed to measure the rigours of this vacant space. But, like habit, imagination, *that household fool*, (cette folle du logis) had surpassed all bounds. The hundreds and thousands of degrees became, after the rigid examination of Fourier, reduced to 50 or 60 degrees only. From 50 to 60 degrees below zero is the temperature which the stellar radiation maintains throughout that indefinite space which is cleaved by the planets of our system.

"You all well remember, gentlemen, with what predilection *Fourier* discoursed to us of this result. You know how well he felt himself assured of having assigned the temperature of space to within eight or ten degrees. How deeply is it to be regretted, that the memoirs, in which our *confrere* had, doubtless, included all the elements of this important determination, is not now to be found. May this irreparable loss at least prove to so many observers, that instead of obstinately pursuing an

ideal perfection which it is not given to man to obtain, they will act wisely in making the public, in the shortest reasonable time, the confidant of their labours.

Annales de Chim. et de Phys. Avril 1838.

Necrology.—M. Dulong.

Science has recently been deprived of one of the most remarkable men of the age, regarded either in relation to the extent of his knowledge, his singular modesty, or the brilliant qualities of his heart. He was born at Rouen on the 12th of February, 1785, and died, after a long illness, on the 19th of July last. Devoted from his youth to the study of the exact sciences, he entered the Polytechnic School at the age of 16, then studied medicine which he practised for sometime at Paris, but soon abandoned it, in order to give up his mind to those labours which are at once an evidence of the depth of his views and the impulses of his understanding. In 1811, scarcely 26 years of age, he undertook those experiments on the Chloruret of Azote, which destroyed one of his eyes and three of his fingers, but which he resumed, as soon as he was cured of his wounds, in order to instruct his cotemporaries in the nature of this dangerous compound. The researches which he published on the mutual decomposition of salts, soluble and insoluble; his fine memoirs on the combinations of phosphorus and oxygen; his observations on some compounds of oxygen and azote, then on oxalic acid and the oxalates; his labours with Berzelius, when the latter was in Paris in 1819, in order to determine anew the proportions of the elements of water and the density of some elastic fluids; and lastly, those in which he was engaged with Thénard, relative to the property of some metals, of promoting the combinations of certain gases, and to the verification of the beautiful experiments of Dobereiner on the inflammation of hydrogen by spongy platina, will claim for him the esteem and gratitude of all future chemists. The students of the Physical Sciences will, perhaps, be still more indebted to him for the instructive researches which he undertook with Petit on the laws of the dilatation of solids and fluids, elastic and inelastic, and on the exact measure of their temperatures; as, also, those on the specific heat of bodies, which placed beyond doubt the fact that atoms of simple substances have equal specific heats, whatever the difference of their chemical nature; an equality so exact, that in determining the number which expresses the specific heat of any one simple substance, the specific heats of all other simple bodies may be numerically deduced from it, by knowing the atomic weights, deducible from their chemical compounds. This ingenious and fruitful thought has greatly contributed to the progress of the study of the atomic theory.

Finally, his beautiful investigation, in conjunction with M. Arago, in 1829, on the relation between the temperature and the pressure of steam in boilers, will always stand as a model of scientific precision and exactness.

A man endowed with so much sagacity and solid acquirement could not remain long a stranger to the learned bodies of Europe. In 1815 (then 30 years of age) he was in nomination with Girard for the place vacant in the section of General Physics, by the death of Levégue, but in this rivalship he had to yield. In 1823 when Fourier was appointed perpetual Secretary in room of Delombre, Dulong was called to fill his place, and he ever afterwards retained that influence in the Academy

which knowledge, modesty and benevolence cannot fail to confer. Successively professor in the School of Alfort, adjunct of Thénard in the faculty of sciences, then professor of Physics, he was appointed a director of the studies of the Polytechnic School at the time of the revolution, in 1830; and never, certainly, was the place more worthily filled. Affable, kind, indulgent, though firm, in his intercourse with the pupils, they were ever accustomed to regard him as a father, and he, in turn, loved them like his children.* In 1832 when Cuvier was taken from the Academy of Sciences, of which he was a principal ornament, Dulong, by the spontaneous, and almost unanimous, choice of his compeers, succeeded him as perpetual Secretary; but his numerous duties and his delicate health did not permit him long to retain those honourable functions. Simple in his tastes and habits, his life, mild and melancholy, was spent in the bosom of an amiable family and with a few devoted friends. Music, at intervals, was the only relaxation which he allowed himself in the midst of his sober occupations. Disinterested, always ready to afford counsel to the young, and constantly forgetting and denying himself, Dulong was the type of a true philosopher, and his death leaves profound regret in the memory of all who knew him. Society and the Sciences have lost in him one of the noblest hearts and most brilliant minds.

Jour. de Pharm. Sep., 1838.

Progress of Civil Engineering.

Influence of Railways in developing the Resources of a Country.

The Irish Railway Commissioners, in their second Report, have collected a number of interesting facts on this important subject, to show the astonishing effects of increased facility of intercourse. The outline which follows, enumerate sthe principal of these:—These effects are not confined to any country or district, although they are, of course, more striking and rapid in rich commercial ones than in others. The extent to which intercourse is not only increased, but actually created by the facility of accomplishing it, would be incredible but for the numerous and authentic examples of it to be seen in so many different localities, and under as various circumstances. The omnibus conveyances between different parts of London and its principal suburbs, (the same thing, it might have been added, having previously taken place in Paris, and other capitals,) are a familiar and striking instance of this fact. And yet the number, a daily increasing one, of these, has not prevented the establishment and success of steamers continually plying between Westminster and London Bridges, and daily conveying many thousands of persons, although it is a contiguous and parallel line to one of the chief directions of the omnibus traffic. Equally surprising is the number of passengers carried by the steamers down the Thames. Upwards of 500,000 persons were conveyed last year by the steamers to Greenwich, and about 300,000 to Woolwich and Blackwall, independent of the tens, or, perhaps hundreds, of thousands, conveyed to Gravesend, Herne Bay, Margate, Ramsgate, &c., and of considerably more than 1,000,000 who

* The pupils of the Polytechnic School have asked the privilege of going into mourning for M. Dulong.

travel to and from Greenwich by the railway. It is, perhaps, still more astonishing that the land conveyances have nevertheless increased with almost equal rapidity. Two coaches, running twice a day, formed the *only* passenger conveyance between London and Woolwich, not longer than thirty years ago. The omnibuses alone now perform the journey forty-eight times per day, besides the numerous vans and coaches which ply between Woolwich and Greenwich, to take passengers to and from the railway. Only two generations back, there was no means of reaching London from Horsham, in Sussex, a distance of thirty-six miles, but on foot or on horseback. Upwards of thirty coaches now pass through Horsham daily, to and from London, besides post chaises, private carriages, &c., while the traffic of goods exceeds 40,000 tons per annum. This change has been solely caused by the construction of a good road. On the Stockton and Darlington road, the passengers conveyed amounted only to 4000 annually, previous to the opening of the railway—they now exceed 16,000. The average number of passengers on the Bolton railroad is now 2500 per week, although it did not previously amount to 300. The coaches running between Newcastle and Carlisle, prior to the railway, were only licensed to carry 343 persons per week, or both ways, 686; now 1596 are, on the average, conveyed the whole distance every week. On the Dundee and Newstyle line, the railway has increased the annual number of travelers from 4000 to upwards of 50,000. Between Liverpool and Manchester, the number of passengers by the coaches was formerly 146,000 in the year; it is now more than 500,000, by the railway alone. The same, if not a more surprising, result has taken place in foreign countries. The former traffic between Brussels and Antwerp consisted of about 75,000 passengers per annum—the railroad has raised it to more than 1,200,000! Similar effects have been experienced in the United States, both in the increase of traveling, and in the rapidity and denseness with which the vicinity of railroads and of steam navigation has become located and peopled. Hence the great stimulus which has been given to the construction of railroads in that country; in January, 1835, full 1600 miles of railway had already been completed in the United States, at a cost of about £8,130,000 sterling. These are direct proofs, observe the commissioners, that Ireland is as capable as other countries of being influenced by the same cause, and the backward state of the country presents a stronger obligation, as well as a wider scope, for improvement. The reports and evidence of engineers and of the Board of Public Works, describe the striking effects produced by the opening of good roads through districts previously shut out from that means of intercourse. The traffic, in most cases, immediately surpassed the most sanguine expectations, and gravel roads frequently became so worn in the second year, as to require a substantial covering of broken stones. Until within the last twenty years, coaches and other public conveyances were almost entirely confined to the main roads leading from Dublin to the principal towns, the cross roads from one town to another being without any such accommodation. At that time, Mr. Bianconi, a native of Milan, (said to have been, like so many of his poor countrymen, a traveling vender of images, in which humble trade he had, by great industry and frugality, saved a few pounds,) undertook the speculation of running a car between Clonmel and Cahir, though almost unacquainted with the English language, and scarcely possessing the means of buying a horse and car.

The attempt was, however, successful, and his business has so steadily increased, that his cars now travel all over Munster, and through Kilkenny to Wexford, Carlow, and Mountmellick, in Leinster, and into Sligo and Leitrim in the north-west. He has now ninety-four well appointed, two horse cars (the description of carriage adopted by him, and one of the best means of conveyance in Ireland,) in constant work, and running more than 3000 miles per day. The same improvement followed the introduction of steam navigation. On the Lower Shannon, from Limerick to Kilrush and Tarbert, a steamer was established in 1829, going and returning on alternate days. Independent of the great benefit to those towns, a thriving bathing village has been created at Kilkee, on the previously desert shore, and the neighbouring villages have become places of considerable resort and importance. The traffic now gives full employment to two steamers of large dimensions, which perform the voyage every day. They carried last year 22,417 persons. A similar increase of intercourse has taken place on the Upper Shannon, by means of one large and several smaller steamers plying between Limerick and Shannon Harbour, whence it is continued to Dublin by the Grand Canal. The steamers between Cork and Cove also carried upwards of 10,000 passengers in 1836. Between Great Britain and Ireland, the traffic and intercourse are calculated to have augmented at least twenty-fold since the establishment of steam navigation. The annual number of passengers conveyed between Liverpool and Dublin by the Post Office packets alone, is now about 26,000, and 15,600 persons passed last year between the small port of Drogheda and Great Britain. The increase of traffic in goods between Ireland and Great Britain, has been fully equal to that of personal intercourse. Steamers now regularly ply from Cork, Waterford, Wexford, Dublin, Drogheda, Dundalk, Newry, Ardglass, Belfast, Coleraine, and Londonderry, to London, Bristol, Liverpool, or Glasgow; from two to four of those vessels cross between Dublin and Liverpool every day. Nine-tenths of this traffic (such as that in fat cattle) is entirely new, and even the rest has assumed a degree of importance previously never dreamed of. The value of the eggs exported was alone estimated, in 1835, at £156,039. Even the manner of transacting business has undergone no less a change. Country dealers now find it worth their while to go themselves to sell their goods and make purchases, instead of employing agents in Dublin and elsewhere, as they did formerly. A well arranged system of railways in Ireland would have the effect of continuing and extending through the country the benefits the outports have obtained by the introduction of steamers. For instance, the fat cattle and sheep sent to Great Britain are now entirely drawn from the counties adjoining the eastern ports, or connected with them by canals, as fat animals cannot, without serious injury, be driven any considerable distance. The great feeding counties of Limerick, Clare, and parts of Tipperary and Queen's County, are therefore precluded from participating in these advantages, but a railroad passing from Dublin through those counties would open to them the markets of Liverpool, Manchester, and Birmingham. Among the inducements worthy of notice, as holding out a prospect of support to railroads, may also be mentioned, the numbers from all parts of Great Britain, and even from the Continent, who would resort to Ireland to view the natural beauties of its splendid and varied scenery, and some, no doubt, to acquire a more perfect knowledge of the character and

condition of its people. The proposed line to Cork, passes within a morning's drive of Killarney, and through a highly picturesque country; and should a railroad be eventually constructed to Holyhead, or some other port in North Wales, as the shortest and safest communication with Ireland and America, the tourist might then combine, in a journey of a few days, and at a very moderate expense, the magnificent scenery of North Wales, and the most beautiful and remarkable places in Ireland, from which source a large accession of passenger traffic could not fail to arise during the summer and autumn months. But the moral effects of this intercourse would even outweigh the pecuniary considerations connected with it. Notwithstanding the public discussions to which Ireland has given rise for years past, she is really little known to the British people. Such an influx of visitors to that country would, therefore, produce the most beneficial results, by greatly tending to dissipate that ignorance of each other's habits and feelings, by drawing the inhabitants of the three countries into a closer connexion and intercourse, and by giving a more practical reality to the bond of the union. It would be endless to point out the various other advantages which would arise from this large increase of intercourse and rapidity of communication between Great Britain and Ireland. Among these, the immense benefit from the great saving of time in the transmission of letters, in traveling, and in the conveyance of goods, will readily suggest itself to every man engaged in business. Another prominent advantage would be the effect on the military service of the country, and its influence on the public peace, from the facility and rapidity with which large bodies of troops, with their artillery and stores, and arriving quite fresh at the scene of action, instead of worn out with long and forced marches, could be conveyed at an hour's notice across the kingdom, either to repel foreign aggression, or to suppress domestic outrage. "It would, in fact," adds the report, "be folly to attempt to impose limits to the future influences of this principle, in creating new resources for the population, or in giving directions as yet unknown, to those already possessed. What has already been done upon its very threshold, and, as it were, in the dark, seems but an earnest of advantages to come, when experience shall have shed its full light upon the subject, and brought this wondrous power more within the grasp and the command of man."—*Abstracted from the "Second Report of the Irish Railway Commissioners."*

Lond. Min. Journ.

Artesian Wells.

Mr. Webster observed, that an Artesian well is produced by boring through strata impervious to water, down to another stratum containing water, and so placed that this fluid will rise up through the bore by hydrostatic pressure; that is by the pressure of another part of the water on a higher level. He then pointed out what he considered to be the true source from whence the water found below the London clay, is derived. We must first imagine a great depression in the chalk stratum that covers the chief part of the south-east of England, the boundaries of which depression or basin is marked by the North Downs, Marlborough Downs, and the Chilton Downs, where the chalk is on the surface. Within this depression, we must then conceive a great stratum of sand, lying in the chalk, but less extensive,—or rather several strata of sand alter-

nating with several beds of coarse pipe-clay, but in a very irregular manner. This bed is named the sand and plastic clay; and this sand contains a large quantity of water, so as to be, in some places, almost of the nature of quicksand. Over these last strata lies a very thick one of dark blue clay, called the London clay, which being less extensive still than the sand, leaves a portion of the latter exposed in a belt or outcrop all round the basin. Now when rain falls upon the chalk downs, it descends the slopes in streamlets towards the centre of the basin; and when it meets with the sand uncovered, it sinks into it, passing downwards below the London clay. In course of time, from this cause, the whole of the sand stratum has become full of water, and must continue to be so, except the latter should be drawn out: and it is evident that this water stratum can be exhausted only by raising out of it a quantity of water greater than the supply it receives from the hills all round. The rain which falls upon the London clay cannot add to the water beneath it, since this clay is impervious; and, therefore, land-springs only are found on the top. If a boring be made anywhere through the blue, or London, clay, down to the stratum or sand containing water, the latter will rise in the bore with considerable force, to the same height, or level, as the outcrop of sand between the London clay and the chalk. If this boring be made at a spot which is on a lower level than the source, the water will spout up like a fountain; but if the boring be made in a place where the surface of the ground is higher than the source, then the water, though it will rise, will not reach the surface: and this accounts for the various heights to which the water ascends in various Artesian wells. (We omit the description of the mineralogical characters of these strata, and of the fossils they contain, and confine ourselves to the circumstances connected with the water.) During the last twenty years, a great many perforations have been made through the London clay, from its having been found that simple boring with an auger is sufficient when a small supply only is required: and enough has been done, fully to establish the truth of the geological principle, that the sand stratum, bearing water, extends all under the London clay; and the metropolis stands upon a chalk basin containing an immense quantity of pure soft water, sufficient for the supply of many breweries, and numerous private houses, &c. But now comes the question: is this pure soft water sufficient in quantity, not merely for the consumption just mentioned, but for the supply of the whole metropolis, or of several parishes, or of a single parish? With respect to the actual quantity of water in the basin, it is impossible to calculate it with any certainty; for although we can estimate the extent of the sand and water stratum from the map, yet we cannot ascertain its thickness, since this varies in different places. In by far the greater number of borings the thickness has not been taken account of, because the work generally ceases at the top of the sand, when water appears: to say nothing of the impossibility of knowing the proportions of water and sand. Mr. Webster went on to prove that this stratum of sand and water is extremely irregular, and that we cannot have a clear idea of its actual nature, except a much more accurate account of the borings was kept than had been the case. The sand stratum is subdivided, in all probability, by bands of clay: and it is incorrect to assert, as has been done, that it is possible to predict success in sinking in one place, because a successful boring has been made in another; or that the supply of water will be the same in all places. All mention has been

omitted, when speculating on this project, of the well-known failure of many Artesian wells: and it is certain that, in several cases, one well has taken the water from another, proving that the supply in that locality was limited. Mr. Webster next adverted to an experiment which had been made by the New River Company, in endeavouring to avail themselves of the water below the London clay, by sinking a large shaft or well at their reservoir in the Hampstead Road. At a depth of 170 feet they came to the stratum of sand and water, which rose up together, as is usual, into the well; but finding that they could not sufficiently separate the water from the sand, which is the chief difficulty in forming wells on a great scale in the London clay, they passed through this running, or quick, sand, by means of cast-iron cylinders, at an expense of 4,000*l.*, independent of the 8,000*l.* which the well cost, hoping to obtain water by sinking into the chalk below. They found water in that stratum, but in quantity too inconsiderable for their object; and hence this well has been represented as a failure. Mr. Webster stated, that considering this experiment as an important one, he applied to Mr. Mylne, engineer to the New River Company, for information respecting it, and received from him all the information he required. A remarkable discrepancy had appeared in the public statements respecting this well; on one side it having been termed a failure, whereas information was given to the vestry of St. Pancras by one of the workmen who had been employed, that water had been obtained at the rate of 6,350,400 gallons weekly; this Mr. Mylne explained by stating that the term *failure* had been used, not as implying that they had not got water, but that they had not procured it in sufficient quantity to answer their purpose as *matter of trade:* the actual quantity being only 650,000 gallons per week, instead of 6,350,400; less than one-ninth part of what had been reported! Mr. Mylne likewise stated that, so far was the supply from being constant, they were able to work the pump in raising the water, only one-third of their time; because, when they had procured what water trickled in slowly through the chalk, they were obliged to wait until a sufficient quantity was again collected. Mr. Webster seemed to consider the idea of a certain supply of water in the chalk, independently of that in the sand stratum, as a fallacy, or at least extremely problematical; and that the water found there had proceeded from the sand stratum resting upon it, and which had forced its way downwards through numerous minute fissures in the chalk. He observed that the procuring much water at a number of points considerably distant from each other, by no means demonstrated, as had been asserted, the certainty of raising the same quantity by means of a single large well; and he further observed, that since it was a manifest and great advantage which the inhabitants of London now possessed, and which was unknown formerly, that they can have numerous supplies of fine spring water by boring only, it was well worth consideration whether the sinking large shafts, and employing powerful machinery to raise water, might not disturb the sand and water stratum to some distance, so as to destroy, or injure, the subterranean channels by which water reaches those wells, which are already the property of individuals; while at the same time no reliance can be placed on the continuance, without interruption, of a supply on so great a scale as is contemplated from this source. Upon the whole, Mr. Webster gave it as his opinion, that proper and sufficient data had not yet been collected, to establish, upon good authority, the existence of water in sufficient abun-

dance to afford a constant supply to the metropolis, or even a considerable district, by raising it in a single place from below the London clay, notwithstanding borings, or Artesian wells, dispersed through London, fulfil their object in furnishing manufactories, and many private houses, with water.

With respect to the present supply of water to the metropolis, Mr. Webster observed, that although the subject did not come properly within the scope of his lecture, he would just state, that a considerable degree of misapprehension still existed on the subject. The Thames water is often represented as of bad quality. There is no doubt, that in its progress through the capital, it is rendered very impure; but it has been abundantly proved, by the accurate analysis of the most eminent chemists, that when the supply is taken sufficiently high up the river, and conducted into the town in a proper manner, it is of great purity. At present the parishes of St. Marylebone, St. George's, and St. James', are supplied from parts of the river much beyond the influence of the London drainage. Possessing this, and other excellent sources, we cannot be said to be unfavourably situated by nature respecting a necessary of life of the first importance. Athenæum.

Mr. S. Crosley's Pneumatic Telegraph.

The following is a description of the pneumatic telegraph recently proposed by Mr. S. Crosley:—

Atmospheric air is the conducting agent employed in the operation of the pneumatic telegraph.

The air is isolated by a tube extending from one station to another; one extremity of the tube is connected with the gas holder, or collapsing vessel, as a reservoir to compensate for any diminution, or increase, of volume arising from compression, or from changes in the temperature of the air in the tube, and for supplying any casual loss by leakage. The other extremity of the tube terminates with a pressure index.

It will be evident to every one acquainted with the physical properties of atmospheric air, that if any certain degree of compression be produced and maintained in the reservoir, at one station, the same degree of compression will speedily extend to the opposite station, where it will become visible to an observer by means of the index.

Thus, with ten weights producing ten different degrees of compression, distinguished from each other numerically, and having the index at the opposite station marked by corresponding figures, any telegraphic numbers may be transmitted, referring, in the usual way, to a code of signals, which may be adapted to various purposes, and to any language. The only manipulation is that of placing a weight of the required figure upon the collapsing vessel at one station, and the same figure will be represented by the index at the opposite station.

In establishments where the telegraphic communications do not require the constant attendance of a person to observe them, and where periodical attendance is sufficient, the signals may be correctly registered on paper, by connecting with the air tube an instrument called a *pressure register*, also invented by Mr. Crosley, which has been successfully employed in large gas light establishments upwards of fourteen years, for registering the variations of the pressure of gas in street mains. The same instrument produces also an increased range of the

index scale, by which means the chance of errors from minute divisions is obviated.

The projector of the pneumatic telegraph is not in possession of any experimental results on a practical scale by the electro-magnetic, or by the hydraulic, telegraphs, employed at any considerably extended distances, or of their continued operation for any long period of time; nor can he offer much decisive information, of a practical nature, analogous to the operation of the pneumatic telegraph on these points; the following circumstances may, however, be referred to:—

There has been upwards of twenty years experience in the transmission of gas for illumination through conduit pipes of various dimensions. In several instances, the gas has been supplied at distances of from five to eight miles, by low degrees of pressure. As one proof of great rapidity of motion, it has been observed, that when any sudden interruption in the supply has occurred at the works, the extinction of all the lights, over large districts, has been nearly simultaneous. Another instance of the great susceptibility of motion which frequently happens, is the flickering motion of the lights at great distances when water has accumulated in the pipes.

The only experience in the transmission of atmospheric air through conduit tubes, which applies more particularly to this subject, may be referred to at three railway establishments, viz. Edinburgh, Liverpool, and Euston-square, London. In these establishments, air tubes, from $1\frac{1}{4}$ to 2 miles in length, have been employed for the purpose of giving notice when a train of carriages is ready to be drawn up the inclined plane by the stationary engine at the summit, so that it may, without delay, be put in motion. This notice is communicated by blowing a current of air through the tube at the foot of the inclined plane, and sounding an organ pipe, a whistle, or an alarm bell, at the stationary engine. It will be satisfactory to know, that this operation has been regularly performed from two to four years, without one single failure or disappointment.

It may further be noticed, that a trial was made with a tube of one inch in diameter, very nearly two miles in length, and returning upon itself, so that both ends of the tube were brought to one place:—the compression applied at one end, was equal to a column of seven inches of water; and the effect on the index at the other end, appeared in fifteen seconds of time.

Laws have been propounded by eminent men on the expenditure of aeriform fluids through conduit pipes, and of the resistance of the pipes; but these are not strictly applicable to the present question. Under all circumstances, it seems desirable that experiments on a practical scale, at extended distances, should be resorted to, as the most satisfactory guide for carrying into effect telegraphic communications of this kind.

Lond. Mech. Mag.

Prevention of Railway Accidents. *By* William Russell.

In the humble hope of drawing more efficient pens to the subject, I offer the following hints:—

1. When a person is in danger of being run over by a train, if he had the presence of mind to get into either of the *outside* spaces, it would be safer than in the *middle one*, (a presumed reason for which will be seen in the 5th article.)

2. Whether the individual be in *the middle space*, or in *either of the lines*,

he should immediately *fall flat on the ground*; it would, in the former case, prevent the commotion of air consequent on the rapid motion of the train, from drawing any portion of his dress towards the carriages; and in the latter case, the entire train would roll over him without doing him the slightest injury, as was exemplified in the case of a Pole, an officer on the Great Western Railroad, who, sometime ago, escaped unhurt, with the exception of a hot cinder falling from the furnace and slightly scorching his face: it is consequently *preferable to lie on the face*; *the hat* should also be *thrown off*, as there might otherwise be a chance of it coming in contact with some projecting point of the train.

3. It is therefore *safest*, when the individual cannot get to either of the *outside spaces*, (which is undoubtedly the best) to throw himself *flat on the ground*, in the *middle space*, or in *either of the lines*.

4. It is consequently an obvious duty which the various companies owe to humanity, to have their carriages so constructed that there would be sufficient space from the bottom of each (including cross beam or iron work) to the bottom or bed of the lines, that a man of the largest dimensions might lie there unhurt.

5. *The middle space is particularly unsafe* for any one to stand on, when there are two trains going in contrary directions and passing each other at the same instant: in proof of which, a poor man, about a fortnight ago, going to his daily labour, and having to cross the railroad at Kinton, near Harrow, whilst a train was approaching from the Euston-square terminus, instantly ran to *the middle space*, thinking, no doubt, that *there* he would be perfectly safe—but another train, at almost the same instant of time, coming up in a contrary direction, caused such a *commotion of air*, first from being agitated by the one train from east to west, and next this agitated air being met by the other train from west to east, that the poor man must have been, as it were, in the midst of a powerful *whirlwind*, and entirely under its impulse: we may, therefore, without hesitation, come to the conclusion, that his dress must have been blown about in every direction, and consequently come in contact with one of the carriages—thus drawing him towards inevitable destruction. The *commotion of air* here hinted at, may be supposed *hypothetical*; but let a reflecting mind pause before it comes to this conclusion; let a rational being ask himself what effect a body, of the weight and magnitude of an ordinary train, rushing through the air, at the rate, let us say, of 30 miles an hour, or 14⅔ yards in one second; and another similar body passing by in an opposite direction at the same velocity, through a fluid so subtile as atmospheric air is known to be, and he cannot but be convinced that the agitation must indeed be terrific: hence the poor fellow lost his life. I would say then *avoid the middle space by all means, or, if you prefer it, fall flat upon the ground, with the face downwards.*

6. Might not some simple contrivance, say of the form of an arc of a circle, or that of the fin of a fish, with a spring attached to it, be so placed on either side of *the tender or first carriage*, as to throw off to the right or left any body that might accidentally come in contact with the same?

7. There ought to be the greatest possible vigilance enforced on those officers whose duty it is to see that no impediments be permitted to the free ingress and egress of the trains; and upon no account whatever should their attention be directed to any object unconnected with their duty, more especially when there is a train either on the point of start-

ing, or when near any of the places where they stop. The following account shows the listlessness—I might say heartlessness—of one of those men. "Lord Litchfield and three of his friends were nearly killed about a month ago: the *hour* of the Manchester train was *changed without any notice*, which is a very common occurrence; and when his lordship got to Birmingham, it was gone. His lordship felt very much annoyed, as his royal highness the duke of Sussex and a large party were coming to dine at his seat, Ranton Abbey; he asked whether he could have an engine for himself and party, which was immediately provided. Away they went at great speed, but, owing to the *negligence of a policeman*, in not turning a plate, they were carried with great force *off the line*, and upset into a pit. They were all much injured."

8. In tunnel transits, I would recommend fire works (say a small Catharine wheel) to be placed on the first carriage, to be lighted at the moment of entry, and so constructed as to burn during the entire transit; that the lights should likewise be of one colour for the left hand line, and of a different colour for the right hand one: this would, to a certainty, be the means of preventing such serious accidents as that which happened at the tunnel running from Chalk Farm to the vicinity of Kilburn, when Pickford's train and another came so furiously in contact as to demolish some of the carriages, besides seriously injuring many, and alarming all, of the passengers.

9. In conclusion. If methods such as I have now stated, or others that may be more efficient, be not adopted, the public will, or at least ought, to demand, I say, *emphatically*, *demand*, that *the speed be lessened*. Let the companies look to this; it would certainly not, in a pecuniary point of view, be to their interest to lessen the motion—let them, therefore, apply other remedies.

Ibid.

Mechanics' Register.

Substitute for the Sun.

The newly invented light of M. Gaudin, on which experiments were recently tried at Paris, is an improved modification of the well known invention of Lieutenant Drummond. While Drummond pours a stream of oxygen gas, through spirits of wine, upon unslaked lime, Gaudin makes use of a more etherial kind of oxygen, which he conducts through burning essence of turpentine. The Drummond light is fifteen hundred times stronger than that of burning gas: the Gaudin light is, we are assured by the inventor, as strong as that of the sun, or thirty thousand times stronger than gas, and of course ten times more so than the Drummond. The method by which M. Gaudin proposes to turn the new invention to use is singularly striking. He proposes to erect in the island of the Pont Neuf, in the middle of the Seine, and centre of Paris, a lighthouse five hundred feet high, in which is to be placed a light from a hundred thousand to a million gas pipes strong, the power to be varied as the nights are light or dark. Paris will thus enjoy a sort of perpetual day; and as soon as the sun of the heavens has set, the sun of the Pont Neuf will rise.

Ibid.

Wheatstone's Electrical Telegraph.

On the bank by the side of the Great Western Railway, the directors are now laying down iron tubes containing wires, for communicating with the various stations, by means of Wheatstone's electrical telegraph. The advantages, if it succeed, will be immense; the expense, we have heard, is about £100 per mile.

Ibid.

LUNAR OCCULTATIONS FOR PHILADELPHIA, JULY, 1839.					Angles reckoned to the right or westward round the circle, as seen in an inverting telescope. For direct vision add 180°	
Day.	H'r.	Min.	Star's name.	Mag.	from Moon's North point.	from Moon's Vertex.
13	7	38	Im. ψ Virginis	5.6	34°	80°
13	8	38	Em.		270	319
23	12	49	Im. δ Capricorni	3,4	189	206
23	13	23	Em.		243	267

Meteorological Observations for February, 1839.

Moon.	Days	Therm. Sun rise	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inch's	Inch's			Inches.	
	1	26	32	30.00	29.95	N.E.	Moderate.		Cloudy—do.
	2	24	26	29.80	80	W.	Brisk.		Clear—do.
	3	20	35	75	75	W.	do.		Clear—do.
	4	33	41	75	89	W.	Moderate.		Flying clouds—do. do.
	5	19	27	30.06	30.06	N.W.	Brisk.		Clear—flying clouds.
☽	6	10	17	25	25	W.	do.		Clear—do.
	7	12	36	35	25	S.W.	Moderate.		Clear—partially cloudy.
	8	28	48	25	00	S W.	do.		Clear—partially cloudy.
	9	38	38	29.61	29 90	W.	do.		Cloudy—clear.
	10	14	24	30.30	30.25	N.W.	do.		Clear—do.
	11	20	36	30	29.93	N.S.W.	do.		Clear—cloudy.
	12	24	34	30	30.25	N.W.	do.		Clear—do.
⊗	13	22	40	25	10	E.S.E.	do.		Clear—do.
	14	25	44	10	08	N.S W.	do.		Clear—do.
	15	30	40	00	00	E.W.	do.		Clear—do.
	16	26	40	05	05	N.E.	do.		Clear—cloudy.
	17	30	34	29.90	29.90	E.	do.	.09	Cloudy—snow.
	18	34	36	87	30.02	N.	do.		Cloudy—flying clouds.
	19	22	35	30.24	26	W.	do.		Clear—do.
	20	26	46	15	15	S.W.	do.		Clear—do.
☾	21	34	47	06	10	S.W.E.	do.		Cloudy—partially do.
	22	34	44	10	16	E.	do.		Clear—partially cloudy.
	23	35	48	10	10	W.	do.		Cloudy—do.
	24	36	46	20	10	E.N.E.	do.		Cloudy—lightly do.
	25	42	50	29.20	29 80	E.W.	do.	.29	Rain—cloudy.
	26	35	38	60	65	N.E.E.	do.	.70	Cloudy—rain.
	27	35	47	40	42	S.W.W.	do.		Cloudy—do.
	28	32	50	47	36	N.W.E.	do.	.85	Cloudy—rain and snow.
	Mean	27.35	38.53	29 98	29.98			1.93	

	Thermometer.	Barometer.
Maximum height during the month.	50. on 25th and 28th.	30.35 on 7th.
Minimum " " "	10. 6th.	29.20 25th.
Mean	32.946	29.98

We

Coll o v		Cloudy.	Rain.	Snow.
1	F	16⅔		
2	M			
3	B			
4	L			
5	N	10⅓	3	3
6	M	12⅓		
7	P			
8	W			
9	S			
10	L			
11	S	19⅓	3	2
12	B	25.	5	7
13	C			
14	D	18⅓	1	3
15	L	20	2	6
16	Y			
17	L			
18	D			
19	N	25⅓		6
20	C			
21	B			
22	Ti			
23	Ly			
24	Un			
25	M	21	5	4
26	Ju	23⅔		
27	Pe			
28	Cu	22⅔	3	
29	Ad	21⅓	1	3
30	Fr	2⅔		
31	Hu			
32	Ce	24⅓		
33	Po			
34	M'	25⅓		
35	Cl			
36	Ca			
37	Be			
38	So			
39	Ind			
40	Jef	2⅔		
41	Wa			
42	Ve			
43	Ar			
44	We			
45	Fay			
46	Gre			
47	Wa	2⅓		
48	All			
49	Bea			
50	But			
51	Mer			
52	Cra	1	2	4
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INDEX.

AMERICAN PATENTS, LIST OF, WITH EDITOR'S REMARKS.

May, 1838.

ERRATUM. P. 323, line 14, for "*relative* or whirling," read "*rotative* or whirling."

SECT

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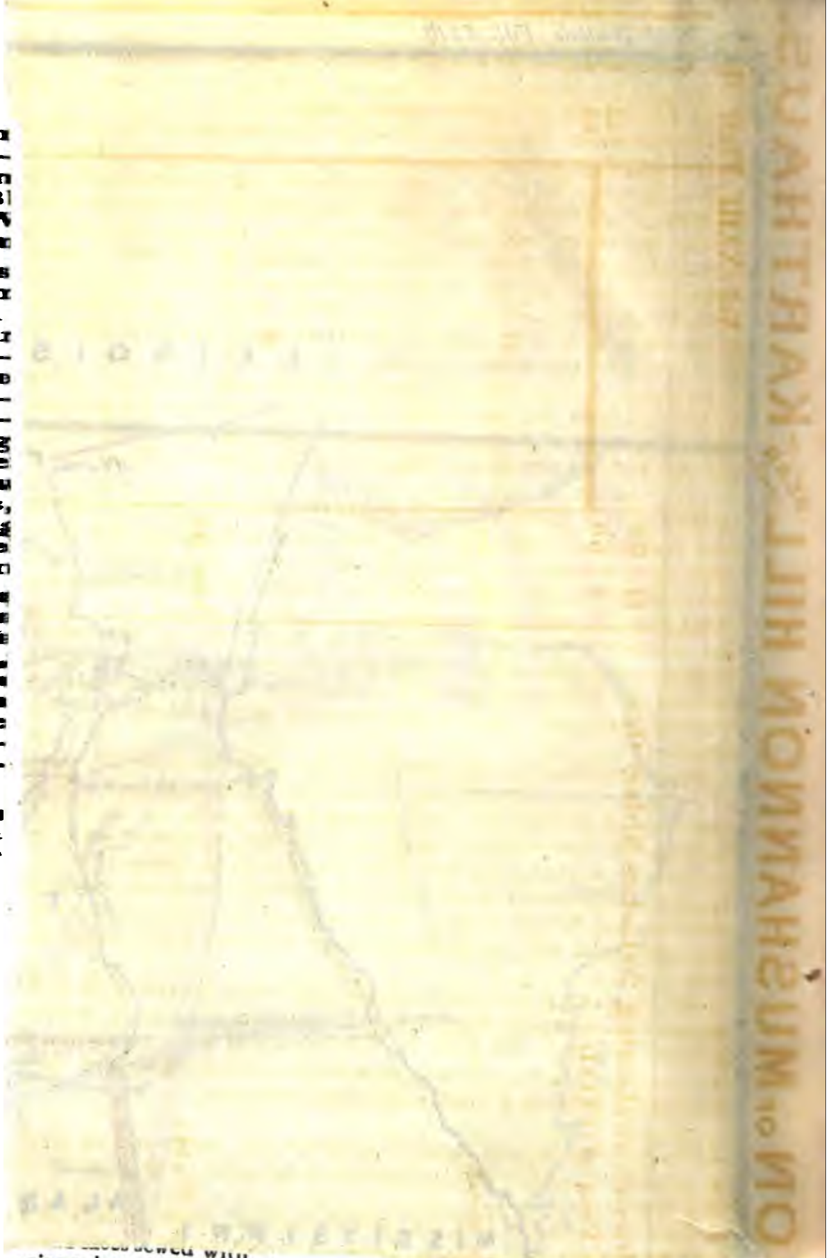
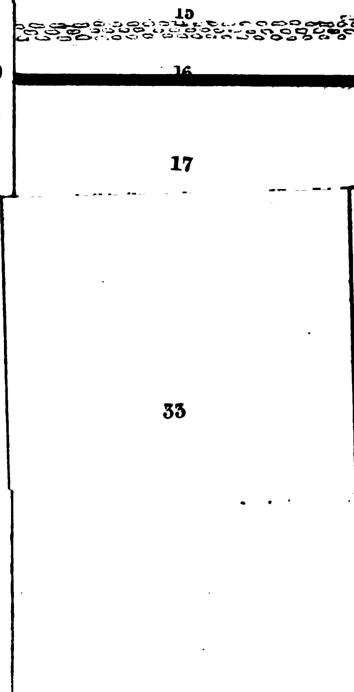
P.S. Duval, Lith. Phil.



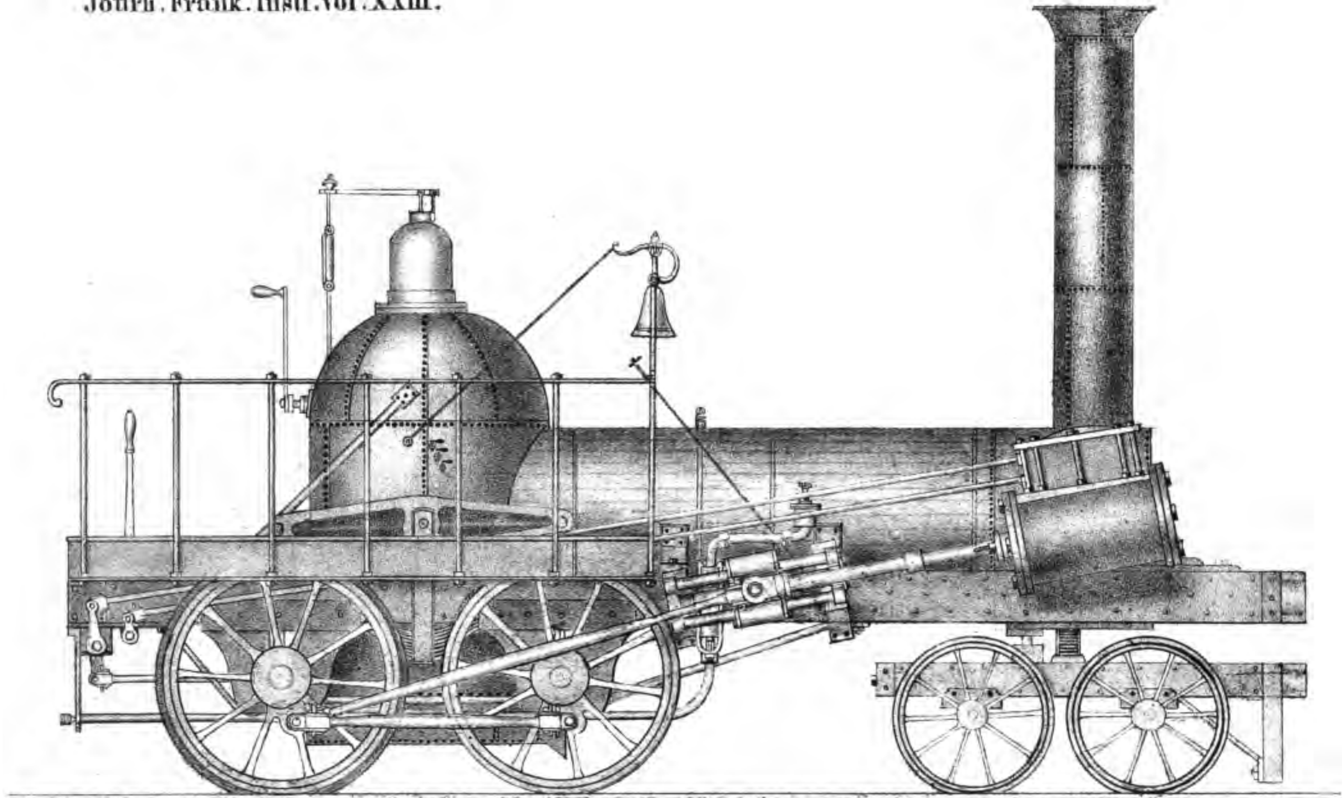
ERRATUM. P. 323, line 14, for "*relative* or whirling," read "*rotative* or whirling."

SECTION OF MUSHANNON HILL NEAR KARTHAUS.

Vol. XXIII. Plate II.

15	Ore Ground, containing 26 Inches Kidney Ore	11.00		
16	Little Vein of COAL	1.00		344.47 343.47
	Rock	20.73		
33	Unproved Strata	239.93		

P.S. Duval, Lith. Phil.



Harrison Jr. del.　　　　On Stone by A. Hoffy.

EASTWICK & HARRISON'S IMPROVED LOCOMOTIVE ENGINE